DEPARTMENT
OF
COMMERCE

MISCELLANEOUS
PUBLICATIONS
OF THE
NATIONAL
BUREAU
OF
STANDARDS

NOS. 277 SUPPL. 1,
278 - 280

Photonuclear Data Index

January 1965 through April 1967

United States Department of Commerce
National Bureau of Standards
Miscellaneous Publication 277—Supplement 1

THE NATIONAL BUREAU OF STANDARDS

The National Bureau of Standards[1] provides measurement and technical information services essential to the efficiency and effectiveness of the work of the Nation's scientists and engineers. The Bureau serves also as a focal point in the Federal Government for assuring maximum application of the physical and engineering sciences to the advancement of technology in industry and commerce. To accomplish this mission, the Bureau is organized into three institutes covering broad program areas of research and services:

THE INSTITUTE FOR BASIC STANDARDS . . . provides the central basis within the United States for a complete and consistent system of physical measurements, coordinates that system with the measurement systems of other nations, and furnishes essential services leading to accurate and uniform physical measurements throughout the Nation's scientific community, industry, and commerce. This Institute comprises a series of divisions, each serving a classical subject matter area:

—Applied Mathematics—Electricity—Metrology—Mechanics—Heat—Atomic Physics—Physical Chemistry—Radiation Physics—Laboratory Astrophysics[2]—Radio Standards Laboratory,[2] which includes Radio Standards Physics and Radio Standards Engineering—Office of Standard Reference Data.

THE INSTITUTE FOR MATERIALS RESEARCH . . . conducts materials research and provides associated materials services including mainly reference materials and data on the properties of materials. Beyond its direct interest to the Nation's scientists and engineers, this Institute yields services which are essential to the advancement of technology in industry and commerce. This Institute is organized primarily by technical fields:

—Analytical Chemistry—Metallurgy—Reactor Radiations—Polymers—Inorganic Materials—Cryogenics[2]—Office of Standard Reference Materials.

THE INSTITUTE FOR APPLIED TECHNOLOGY . . . provides technical services to promote the use of available technology and to facilitate technological innovation in industry and government. The principal elements of this Institute are:

—Building Research—Electronic Instrumentation—Technical Analysis—Center for Computer Sciences and Technology—Textile and Apparel Technology Center—Office of Weights and Measures —Office of Engineering Standards Services—Office of Invention and Innovation—Office of Vehicle Systems Research—Clearinghouse for Federal Scientific and Technical Information[3]—Materials Evaluation Laboratory—NBS/GSA Testing Laboratory.

---

[1] Headquarters and Laboratories at Gaithersburg, Maryland, unless otherwise noted; mailing address Washington, D. C., 20234.

[2] Located at Boulder, Colorado, 80302.

[3] Located at 5285 Port Royal Road, Springfield, Virginia 22151.

UNITED STATES DEPARTMENT OF COMMERCE • Alexander B. Trowbridge, *Secretary*

NATIONAL BUREAU OF STANDARDS • A. V. Astin, *Director*

Photonuclear Data Index

January 1965 through April 1967

Prepared by

Photonuclear Data Group

Institute for Basic Standards
National Bureau of Standards
Washington, D.C.

National Bureau of Standards Miscellaneous Publication 277

Supplement 1

Issued October 1967

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C., 20402 - Price 45 cents

Photonuclear Data Group

T. M. Collins, E. G. Fuller,
J. D. Murphy, and J. S. O'Connell

Foreword

A Photonuclear Data Center is being operated in the Radiation Physics Division of the NBS Institute for Basic Standards with the support of the NBS Office of Standard Reference Data. The objective of the Center project is the creation and maintenance of a current Photonuclear Data File which will be used as source material for a series of miscellaneous reports covering various aspects of the field.

This publication is the first in a series of supplements to the Photonuclear Data Index (NBS Miscellaneous Publication 277), which the Center issued in April 1966. It essentially covers data published in the field of photonuclear reactions in the period from January 1, 1965 through the middle of April 1967. It is expected that additional cumulative supplements will be issued approximately every one and a half to two years. Future publications of the Center will contain critically evaluated data and will be included in the National Standard Reference Data Series.

The NBS Office of Standard Reference Data was established to carry out the Bureau's assigned responsibility to administer the National Standard Reference Data System (NSRDS). This System is a Government-wide effort to give the American technical community optimum access to the quantitative data of physical science, critically evaluated and compiled for convenience. The NSRDS was established by the President's Office of Science and Technology, acting upon the recommendation of the Federal Council for Science and Technology. Its general objective is to coordinate and integrate existing data evaluation and compilation activities into a systematic, comprehensive program supplementing and expanding technical coverage when necessary, establishing and maintaining standards for the output of the participating groups, and providing mechanisms for the dissemination of the output as required.

A. V. Astin, Director.

Contents

PHOTONUCLEAR DATA INDEX
Supplement 1 (1967)

Photonuclear Data Project*

Radiation Physics Division
National Bureau of Standards, Washington, D. C.

This index, a supplement to NBS Miscellaneous Publication 277, primarily covers data published in the period dated January 1, 1965 through the middle of April 1967. Organized by element and isotope, each entry in the index supplies quantitative information for a specific reaction on the ranges of excitation energy, source energy, detected particle energy, and emission angles for reaction produced covered in each reference. Information is also given on the type of measurement and detector used.

Key Words: Bibliography, Data Index, Elements, Isotopes, Nuclear Physics, Photonuclear Reactions.

1. Introduction

The function of this data index is to furnish a means of readily locating experimental data in the field of photonuclear reactions. This index differs from a bibliography in that it supplies quantitative information about the content of a paper. Each entry in the index corresponds to the measurement of a specific photonuclear reaction for a specific nuclide or group of nuclides. An attempt is made to give as complete a description of each measurement as is possible in a single line. The type of measurement is indicated as well as the range of excitation energies covered, the type of detector used and its energy response, and the type of angular distribution data obtained. The object has been to give a description of each measurement that is complete enough to permit an individual looking for specific types of data in the field to locate the pertinent references without having to go through a large number of irrelevant papers as might be the case if only the title of the paper or the reaction studied were listed for each entry.

For the purposes of this index the general criterion as to what constitutes a measurement of photonuclear data is that the measurement must give information on the electromagnetic matrix element between the ground state and excited states of some nucleus. The most common type

*Participants in the photonuclear data project: T. M. Collins, E. G. Fuller, J. D. Murphy, and J. S. O'Connell.

of reactions are: (γ,γ), (γ,n), (γ,p), (p,γ_o), and (e,e'). Two reactions which fit the matrix element criterion, but which were not included in the compilation because of their rather special nature are heavy particle coulomb excitation and the thermal neutron capture reaction (n,γ_o). The energy region of interest is from 0 to about 150 MeV. Most of the experiments are concerned with the excitation energy range 8 to 30 MeV, the region of the giant dipole resonance.

2. Scope of the Data Index

This supplement covers experimental data published in the period from January 1, 1965 through April 1967. In addition, it contains the complete index entry for all the items marked with an asterisk in the original Photonuclear Data Index NBS Miscellaneous Publication 277. In the original index, these entries had been made on the basis of the abstracts of the papers only, not a complete reading of the paper. In preparing this supplement, nine journals were searched, issue by issue. These were: Journal of Experimental and Theoretical Physics (JETP), Journal of Experimental and Theoretical Physics (JETP Letters), Journal of Nuclear Physics-USSR (Sov. J. Nucl. Phys.), Physics Letters, Nuclear Physics, Il Nuovo Cimento, Physical Review, Physical Review Letters, and Zeitschrift für Physik (Z. Physik). Nuclear Science Abstracts was used to find papers in other journals.

Only articles published in journals were abstracted. In a few cases, conference reports were used if the article was fairly complete and it was likely that this was the final report of the experiment.

3. Description of the Index

The data index of each element begins with the isotopic abundances for that element and a list of particle thresholds for each isotope. The abundances were taken from a compilation by Gladys Fuller[1]. This reference should be consulted for remarks concerning the accuracy of these values and possible variations with the source of the sample. The reaction thresholds were taken from a list of Q-values computed by J. H. E. Mattauch, W. Thiele, and A. H. Wapstra[2]. The values given in reference 2 have been arbitrarily rounded off to the nearest 0.1 MeV except for those cases where the uncertainties quoted are of the order of 1 MeV. In these cases, thresholds are given to the nearest MeV.

In the index itself eight categories are used to describe a given paper. These are: Reference Number; Nucleus Excited; Reaction; Type of Information; Excitation Energy Range; Source Type and Energy Range; Detector Type; Energy and Angular Range; and Remarks.

For each element, entries are grouped under six reaction classes. These are: total absorption cross sections; elastic and inelastic photon scattering; inelastic electron scattering, including coincidence experi-

ments with outgoing reaction products; reactions where a neutron is detected, i.e. (γ,n), (γ,xn), (γ,np), etc.; reactions where protons are detected; reactions where particles of mass greater than one or multiple particles are emitted; inverse capture reactions; and photofission.

4. Description of Entries

4.1. Reference Number (REF)

The reference number is used to cite the full bibliographical reference which is given in the bibliography following the data index. This number is made up of the year and the first two letters of the first author's name, plus an additional serial number. For example, a paper published in 1963 by Galileo would have a reference number 63Gal.

4.2. Nucleus Excited (NUCLIDE)

The atomic number (Z), chemical symbol, and mass number (A) of the excited nucleus (not necessarily the target nucleus) is given. The mass number is listed only if the isotopic assignment is unambiguous. In general, it was assumed that the mass number was unambiguous if in the target the abundance of a single isotope was $\geq 97\%$.

4.3. Reaction

The following table defines the symbols used under IN,OUT:

$	polarization of the incident or outgoing particle or polarization or alignment of the target
A	alpha particle
D	deuteron
E	electron
E/	inelastically scattered electron
E+	positron
F	fission
G	photon
G/	inelastically scattered photon
He3	^{3}He
MU-T	total photon absorption
N	neutron

P	proton
T	triton
XN	all neutrons
XP	all protons

When two reaction products are listed under OUT they were detected in coincidence, e.g., the notation E,E/P means the inelastically scattered electron and proton were detected in coincidence in a reaction of the type: $A + e \rightarrow (A - 1) + e + p$, while E, P means that only the proton was detected.

4.4. Type of Information (RES)

The following catalog of abbreviations applies to the type of result obtained in an experiment:

ABI	absolute integrated cross section data $\int \sigma dE_\gamma$
ABX	absolute cross-section data
ABY	absolute yield data
FMF	form factor
LFT	excitated state lifetime
NOX	no cross-section data
RLI	relative integrated cross-section data
RLX	relative cross-section data
RLY	relative yield data
SPC	particle energy spectrum

4.5. Excitation Energy Range (EXCIT)

The excitation energy range of the nucleus involved in the gamma-ray transition is given in MeV. For reactions initiated by gamma rays, the excitation energy is taken as the gamma-ray energy; for reactions initiated by particles, the binding energy and kinematic corrections are made. The abbreviation THR stands for threshold.

4.6. Source Type and Energy Range (SOURCE)

The source of incident particles is characterized by the letter C or D indicating that the source was continuous or discrete in energy. The source energy is indicated under MIN-MAX. The usual source of photons is bremsstrahlung which would be marked C. The range of end point energies is given.

4.7. Detector Type, Energy, and Angular Range (DETECTOR)

The following abbreviations apply under detector TYPE:

ACT	measurement of radioactivity of the target
BBL	bubble chamber
BF3	BF_3 neutron counter with moderator, e.g., Halpern detector, long counter
CCH	cloud chamber
EMU	emulsions (photographic plates)
IØN	ionization chamber
MAG	magnetic spectrometer
MGC	magnetic Compton spectrometer
MGP	magnetic pair spectrometer
MØD	moderated neutron detector not employing a BF_3 counter, e.g., rhodium foil, Szilard-Chalmers reaction, ^3He, ^6Li reactions
NAI	NaI(Tl) spectrometer
SCD	semiconductor (solid state) detector
SCI	scintillator detector other than NaI; e.g., CsI, KI, organic (liquid or solid), stilbene, He
SPK	spark chamber
TEL	counter telescope
THR	threshold detector, e.g., $^{29}Si(n,p)\ ^{29}Al$
TØF	time-of-flight detector

The symbols D or I under TYPE mean that the reaction product was detected differentially or integrally in energy. For example, a scintillator (SCI) is usually used differentially (D) while a BF_3 detector used with a neutron moderator (BF3) integrates over neutron energy. The range of detected particle angular distribution is shown under ANG with the following designations:

0-180	one number in this column means the measurements were made at this angle only (angle in degrees)
4PI	a 4π geometry was used or a method like radioactivity or a total absorption measurement
DST	an angular distribution was measured

4.8. Remarks

This additional information was selected in a fairly unsystematic way and limited by the available space. It should therefore not be regarded as exhaustive or consistent.

Some of the abbreviations used in this column are:

BREAKS	levels located by "breaks" in the yield curve
CF	compared with
COINC	coincidence
DT BAL	detail balance
G-WIDTH	Γ_γ, gamma-ray transition width
J-PI	spin and parity assignments of levels are made
POL	polarization
Q-SQUARE	momentum transfer squared (q^2)
REL	relative
SEP ISOTPS	separated isotope used

5. References

1. Gladys Fuller, 1959 Nuclear Data Tables (NUCLEAR DATA PROJECT)-National Academy of Sciences, National Research Council, Washington, D. C.
2. J. H.E. Mattauch, W. Thiele, and A. H. Wapstra, Nuclear Phys. 67, 32 (1965).

HYDROGEN Z=1

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
1	99.99	*	*	*	*	*	*	*	*
2	1.5(-2)	2.2	2.2	*	*	*	*	*	*
3	*	6.3	8.5	*	*	*	8.5	8.5	*

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	DETECTOR TYPE	MIN-MAX	ANG	REMARKS
55OX1	1H	1	G,G	ABX	20- 98	C 98	TEL-D	20- 98	DST	
61BA3	1H	1	G,G	ABX	247	C260	TEL-D		DST	
61PE2	1H	2	E,E/	ABX	0- 12	D 41	MAG-D		DST	
65BO1	1H	2	E,E/P	ABX	0-100	D350	MAG-D	250-350	60,90	
66GO1	1H	2	E,E/	ABX	0- 6	D 54,70	MAG-D	48- 70	180	
66GR2	1H	2	E,E/	ABX	0- 60	D219-447	MAG-D		DST	
66HU1	1H	2	E,E/	FMF	0- 70	D146-475	MAG-D		DST	
67RA1	1H	2	E,E/	ABX	0- 8	D250-370	MAG-D		180	
66HU2	1H	3	E,E/	FMF	0-160	D250-370	MAG-D	130-360	DST	
57BA1	1H	2	G,N	ABY	30-260	C120-260	THR-I	21	DST	REL YLDS D TO C
64BE8	1H	2	$G,N	NOX	THR- 32	C 32	SCI-D		DST	
65JE1	1H	2	$G,N	NOX	2- 3	D 3	BF3-I		DST	POL NEUT ASYMM
67BA1	1H	2	$G,N	NOX	200-400	C 1GEV	TEL-D		90	
65BO2	1H	3	G,N	ABX	6- 11	D 6- 11	BF3-I		DST	
56DI1	1H	2	G,P	ABX	136-293	C342	TEL-D	40-230	DST	
57AL1	1H	2	G,P	ABX	50-150	C170,264	TEL-D	20- 75	DST	
58TA2	1H	2	G,P	ABX	146-238	C146-238	TEL-D	51-166	DST	
65LI1	1H	2	$G,P	NOX	75-250	C 75-250	MAG-D		DST	POL PHOTON
66KO2	1H	3	G,P	SPC	THR- 33	C 33	TEL-D	4- 14	90	
66KO2	1H	3	G,D	ABX	THR- 33	C 33	TEL-D	4- 9	90	
66GR1	1H	2	N,G	SPC	2	D THM	SCD-D			BINDING ENERGY
61CE2	1H	3	N,G	ABX	16	D 14	TEL-D		4PI	
65AJ1	1H	4	N,G	ABX	11	D 14	SCD-D		0	UPPER LIMIT ABX

HELIUM Z=2

A	ABUND.(1)	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
3	1.4(-4)	7.7	5.5	*	*	*	*	7.7	7.7
4	99.99	20.6	19.8	19.8	20.6	*	*	*	*

(1) ABUNDANCE DEPENDS ON SOURCE

REF	NUCLIDE Z A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	DETECTOR TYPE MIN-MAX	ANG	REMARKS
66HU2	2HE3	E,E/	ABX	0-150	D250-670	MAG-D130-360	DST	
67FR1	2HE3	E,E/	ABX	0- 17	D200	MAG-D	60	
65FR1	2HE4	E,E/	ABX	0- 30	D200	MAG-D160-175	DST	
64GO4	2HE3	G,N	ABX	5-170	C170	CCH-D	DST	
65FE1	2HE3	G,N	ABX	THR-170	C170	CCH-D	DST	
66GE1	2HE3	G,N	ABX	THR- 30	CTHR- 30	BF3-I	4PI	
66VA3	2HE3	G,N	ABX	THR-170	C170	CCH-D	4PI	
58BA3	2HE4	G,NP	RLX	150-280	C280	TEL-D 60-180	DST	NP COINC PSPC
66FE1	2HE4	G,N	ABX	20-80	C 20-80	BF3-I	4PI	
64GO4	2HE3	G,P	ABX	5-170	C170	CCH-D	DST	
65FE1	2HE3	G,P	ABX	THR-170	C170	CCH-D	DST	
65ST1	2HE3	G,2P	SPC	9- 40	C 40	SCD-D 1- 8	90	
65VA1	2HE3	G,2P	ABX	THR-170	C170	CCH-D	DST	
65VA1	2HE3	G,PD	ABX	THR-170	C170	CCH-D	DST	
66VA3	2HE3	G,P	ABX	THR-170	C170	CCH-D	4PI	
60RE2	2HE4	G,XP	NOX	THR-330	C330	CCH-D	4PI	
65AR1	2HE4	G,P	ABX	THR-999	C999	CCH-D	4PI	
65AS1	2HE4	G,XP	ABX	78-300	C250,300	TEL-D 58-128	DST	
65CL1	2HE4	G,P	ABX	24- 56	C 40- 60	SCD-D 3- 10	90	
67BU1	2HE4	G,P	RLY	THR- 54	C 44,54	ACT-I	4PI	
65ST1	2HE3	G,D	ABX	9- 46	C 40,55	SCD-D	90	
65AR1	2HE4	G,D	ABY	THR-999	C999	CCH-D	4PI	
65AS1	2HE4	G,2D	ABX	24-300	C250,300	TEL-D	DST	COINCIDENCE
55GR1	2HE3	P,G	ABX	5- 8	D 0- 2	NAI-D 4- 8	DST	
62GR1	2HE3	P,G	ABX	5- 7	D 0- 2	NAI-D 2- 7	DST	
66BA2	2HE3	P,G	ABX	110	D156	SCI-D 83-122	DST	
66WO1	2HE3	P,G	ABX	7- 14	D 2- 12	NAI-D 5- 20	DST	
67GE1	2HE3	P,G	ABX	7- 9	D 2- 4	NAI-D	90	
65SC1	2HE4	P,G	ABX	20- 23	D 0- 4	NAI-D 20- 24	0	

LITHIUM Z=3

A	ABUND.(1)	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
6	7.42	5.7	4.7	15.8	15.8	1.5	*	3.7	28.7
7	92.58	7.3	10.0	2.5	28.3	2.5	12.9	12.0	29.1

(1) ABUNDANCE DEPENDS ON SOURCE

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX		DETECTOR TYPE	MIN-MAX	ANG	REMARKS
58BE3	3LI	7	G,G	LFT	1	C	1	NAI-D		120	WIDTH
64CH1	3LI	6	E,P	ABX		D	1GEV	MAG-D	110-450	DST	
65CH1	3LI	7	E,E/	ABX	1	D	2- 4	MAG-D	2- 3	162	
58BA3	3LI		G,NP	RLX	150-280	C	280	TEL-D	60-180	DST	NP COINC PSPC
65BA2	3LI	6	G,XN	ABX	THR- 60	C	5- 60	BF3-I		4PI	
65BE1	3LI	6	G,XN	ABX	6- 32	D	6- 32	BF3-I		4PI	
65HA1	3LI	6	G,XN	ABX	THR- 30	C	6- 30	BF3-I		4PI	
66CO5	3LI	6	G,N	ABX	5- 97	C	5- 97	BF3-I		4PI	
66PA1	3LI	6	G,N	SPC	THR- 30	C	30	EMU-D	0- 17	90	
65HA1	3LI	7	G,XN	ABX	THR- 30	C	6- 30	BF3-I		4PI	
65WA1	3LI	7	G,XN	SPC	THR- 25	C	25	EMU-D	2- 13	90	
67BA2	3LI	7	G,N	ABX	THR- 50	C	7- 50	BF3-I		4PI	
66MA1	3LI		G,P	SPC	10- 28	C	32	TEL-D	4- 16	90	
60KO5	3LI	6	G,P	SPC	6- 28	C	28	EMU-D	1- 20	60	
65BA2	3LI	6	G,XP	RLY	THR- 30	C	20, 28	EMU-D	1- 18	DST	
65MA5	3LI	6	G,P	SPC	THR- 31	C	31	SCD-D	3-	90	
65AR2	3LI	7	G,2P	ABY	THR-1GEV	D	1GEV	ACT-I		4PI	NO H5 SEEN
66MA1	3LI		G,D	SPC	10- 28	C	32	TEL-D	4- 16	90	
66MA1	3LI		G,T	ABX	10- 28	C	32	TEL-D	4- 16	90	
59DA1	3LI	6	G,D	ABX	2, 3	D	2, 3	ION-D		4PI	
65BA2	3LI	6	G,T	ABX	19- 25	C	35	EMU-D	1- 10	DST	
65DA1	3LI	6	G,D	ABY	THR- 4	C	4	SCD-D		90	
65MA5	3LI	6	G,D	SPC	THR- 31	C	31	SCD-D	3-	90	
65MA5	3LI	6	G,T	SPC	THR- 31	C	31	SCD-D	3-	90	
66SH1	3LI	6	G,T	ABX	19- 24	C	40	SCD-D	1- 13	90	
55MI1	3LI	7	G,T	ABX	6- 21	C	10,21	EMU-D		4PI	
61SH6	3LI	7	G,T	ABX	5- 9	C	10	EMU-D	1- 4	DST	
65DA1	3LI	7	G,T	ABY	THR- 4	C	4	SCD-D		90	

BERYLLIUM Z=4

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
9	100.00	1.7	16.9	17.7	21.2	2.5	20.6	18.9	*

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	DETECTOR TYPE	MIN-MAX	ANG	REMARKS
65WY1	4BE9		G,MU-T	ABX	10- 35	C 90	SCI-D		4PI	
64LO3	4BE9		G,G	ABX	10- 30	C 10- 30	NAI-D	10- 30	140	
59BA3	4BE9		E,N	ABY	THR- 36	D 10- 36	BF3-I		4PI	
66CL1	4BE9		E,E/	LFT	14- 17	D 40- 60	MAG-D	36- 40	DST	
55BA5	4BE9		G,XN	ABY	30-200	C150-250	THR-I	30-	DST	
64AL5	4BE9		G,XN	NOX	THR- 34	C 34	THR-I	6-	DST	
64KO5	4BE9		G,N	RLY	15- 32	C 35	MAG-D	4- 20	DST	
65CO2	4BE9		G,XN	ABI	6- 80	C 6- 80	BF3-I		4PI	
66CO4	4BE9		G,N	ABI	6- 80	C 6- 80	BF3-I		4PI	
66DE3	4BE9		G,N	SPC	THR- 85	C 85	CCH-D	0- 15	135	
66TH1	4BE9		G,N	SPC	THR- 17	C 17	SCI-D	2- 12	90	
57CH1	4BE9		G,XP	SPC	THR- 84	C 68,84	EMU-D	20- 50	DST	
59CH1	4BE9		G,XP	RLY	THR- 80	C 90	TEL-D	15- 60	DST	REL D TO P YLD
64KO5	4BE9		G,P	ABX	15- 32	C 35	MAG-D	1- 15	DST	
66DE6	4BE9		G,P	ABX	THR- 50	C 20- 50	ACT-I		4PI	
66DE6	4BE9		G,P	ABX	THR- 50	C 20- 50	TEL-D	3- 11	90	
66VO1	4BE9		G,P	ABX	THR- 81	C 21- 81	TEL-D	3- 5	90	
59CH1	4BE9		G,XD	RLY	THR- 80	C 90	TEL-D	15- 60	DST	REL D TO P YLD
64KO5	4BE9		G,D	RLY	15- 32	C 35	MAG-D	4- 14	DST	
66DE6	4BE9		G,D	ABX	THR- 50	C 20- 50	TEL-D	4- 10	90	
66DE6	4BE9		G,T	ABX	THR- 50	C 20- 50	TEL-D	4- 11	90	
66VO1	4BE9		G,D	ABX	THR- 81	C 21- 81	TEL-D	3- 6	90	
66VO1	4BE9		G,T	ABX	THR- 81	C 21- 81	TEL-D	4- 7	90	
65LA1	4BE7		P,G	ABX	160	D155	SCD-D	0- 30	DST	

BORON Z=5

A	ABUND.(1)	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
10	19.61	8.4	6.6	18.7	17.8	4.5	27.0	8.3	23.5
11	80.39	11.5	11.2	11.2	27.2	8.7	19.9	18.1	30.9

(1) ABUNDANCE DEPENDS ON SOURCE

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	DETECTOR TYPE	MIN-MAX	ANG	REMARKS
64LO3	5B	10	G,G	ABX	10- 30	C 10- 30	NAI-D	10- 30	140	
64LO3	5B	11	G,G	ABX	10- 30	C 10- 30	NAI-D	10- 30	140	
65KE1	5B	11	G,G	LFT	2	C 5	NAI-D	0- 3	135	
65FR2	5B	10	E,E/	FMF	6	D100-220	MAG-D	90-220	DST	
65SP1	5B	10	E,E/	FMF	7	D 55	MAG-D	15- 55	DST	J-PI, WIDTH
66KO1	5B	10	E,E/	ABX	0- 18	D 50,60	MAG-D	30- 60	180	
66SP1	5B	10	E,E/	ABX	7	D 32- 57	MAG-D		DST	
64BR2	5B	11	E,E/	SPC	0- 10	D 54	MAG-D		141	
66KO1	5B	11	E,E/	ABX	0- 19	D 50,60	MAG-D	30- 60	180	
66RI1	5B	11	E,E/	FMF	2,4	D	MAG-D		DST	
66SP1	5B	11	E,E/	ABX	2- 9	D 32- 57	MAG-D		DST	
67SP1	5B	11	E,E/	FMF	4,5	D 35- 57	MAG-D		DST	
65HA1	5B	10	G,XN	ABX	THR- 30	C 6- 30	BF3-I		4PI	
65HA1	5B	11	G,XN	ABX	THR- 30	C 6- 30	BF3-I		4PI	
66NE1	5B	11	G,3P	ABY	45-250	C250	ACT-I		4PI	
66PA4	5B	8	P,G	ABX	1- 2	D 1- 2	SCD-D			
65PA1	5B	10	HE3,G	ABX	18- 19	D 0- 3	NAI-D	10- 30	DST	
66FO2	5B	10	A,G	SPC	5- 7	D 1- 3	NAI-D	2- 7	90	
61KN1	5B	11	D,G	ABX	16- 18	D 0- 2	THR-I		4PI	
62SU2	5B	11	D,G	RLX	16- 20	D 1- 5	NAI-D		90	
64SU1	5B	11	D,G	ABX	18- 23	D 0- 5	NAI-D		DST	
66SU1	5B	11	D,G	ABX	16- 21	D 1- 6	NAI-D	0- 25	DST	
66ZI1	5B	11	D,G	ABX	16- 18	D 1- 2	NAI-D		DST	

CARBON Z=6

A	ABUND.(1)	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
12	98.89	18.7	16.0	27.4	26.3	7.4	31.8	27.4	27.2
13	1.11	4.9	17.5	23.9	24.4	10.7	23.7	20.9	31.6

(1) ABUNDANCE DEPENDS ON SOURCE

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	DETECTOR TYPE	MIN-MAX	ANG	REMARKS
56TZ2	6C	12	G,MU-T	LFT	23	C 22- 23	ACT-I		4PI	
65WY1	6C	12	G,MU-T	ABX	10- 35	C 90	SCI-D		4PI	
59PA3	6C	12	G,G	ABX	17	D 15,18	NAI-D	17	90	
59PE5	6C	12	G,G	ABX	19- 61	C 19- 61	NAI-D	15- 61	135	
60BU3	6C	12	G,G	LFT	15	C 23	NAI-D		DST	
61WI1	6C	12	G,G	ABX	40-120	C132	SCI-D		DST	
59BA3	6C	12	E,N	ABY	THR- 36	D 10- 36	BF3-I		4PI	
64BR2	6C	12	E,E/	SPC	0- 20	D 54	MAG-D		141	
64CH1	6C	12	E,P	ABX		D 4GEV	MAG-D	110-450	DST	
66CR1	6C	12	E,E/	FMF	4,10	D600-800	MAG-D		DST	
66PR1	6C	12	E,E/	NOX	14- 21	D100-200	MAG-D		180	
67CR1	6C	12	E,E/	FMF	0- 10	D100-200	MAG-D		DST	
67CR2	6C	12	E,E/	FMF	19	D400-800	MAG-D		DST	
55BA5	6C	12	G,XN	ABY	30-200	C150-250	THR-I	30-	DST	
55SP2	6C	12	G,N	RLY	THR- 20	C 17- 20	ACT-I		4PI	BREAKS
56TZ1	6C	12	G,N	RLY	22- 24	C 22- 24	ACT-I		4PI	
57BA1	6C	12	G,N	ABY	30-260	C120-260	THR-I	21	DST	
58BA5	6C	12	G,XN	RLY	THR- 23	C 18- 23	BF3-I		4PI	BREAKS
59SA1	6C	12	G,N	NOX	THR- 19	C 18- 19	ACT-I		4PI	BREAKS
59SA1	6C	12	G,N	NOX	19- 21	C 18- 21	MOD-I		4PI	BREAKS
62FI2	6C	12	G,N	RLX	21- 29	C 25- 32	TOF-D	2- 15		
64AL5	6C	12	G,XN	NOX	THR- 34	C 34	THR-I	6-	DST	
64BE8	6C	12	$G,N	NOX	THR- 32	C 32	SCI-D		DST	
65BA1	6C	12	G,XN	ABX	THR- 52	C 18- 52	BF3-I		4PI	
65MI1	6C	12	G,XN	ABX	THR- 30	CTHR- 30	BF3-I		4PI	
65VE1	6C	12	G,N	SPC	THR- 33	C 34	TOF-D	1- 14	DST	
66BA4	6C	12	G,N	ABX	THR- 52	C 18- 52	BF3-I		4PI	
66BI1	6C	12	G,N	ABX	20-200	C 20-200	BF3-I	0- 50	4PI	
66CO2	6C	12	G,N	ABX	THR- 65	CTHR- 70	ACT-I		4PI	
66FO1	6C	12	G,N	ABX	18- 70	C 18- 70	ACT-I		4PI	
66FU1	6C	12	G,N	ABX	18- 37	D 18- 37	BF3-I		4PI	
66LO1	6C	12	G,N	ABX	21- 27	D 21- 27	ACT-I		4PI	
66MA2	6C	12	G,NG/	RLX	21- 31	C 21- 31	NAI-D			

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	DETECTOR TYPE	MIN-MAX	ANG	REMARKS
57CH1	6C	12	G,XP	SPC	THR- 84	C 64,84	EMU-D	18- 54	DST	
57LI1	6C	12	G,XP	SPC	THR- 35	C 35	EMU-D	5- 12	DST	
59CH1	6C	12	G,XP	RLY	THR- 80	C 80	TEL-D	15- 45	90	REL D TO P YLD
64SE1	6C	12	G,XP	SPC	THR- 24	C 24	EMU-D	2- 8	DST	
66MA2	6C	12	G,PG/	RLX	21- 31	C 21- 31	NAI-D			
66PA2	6C	12	G,P	SPC	THR- 55	C 55	SCI-D	34	DST	
55CA2	6C	12	G,3A	ABX	12- 18	D 15,18	ION-D	6- 12	4PI	
55CA2	6C	12	G,3A	ABX	12- 18	D 15,18	EMU-D	4- 12	4PI	
55GL1	6C	12	G,A	SPC	17	D 14,17	EMU-D	1- 7	4PI	
55GO1	6C	12	G,3A	SPC	THR- 60	C 60	EMU-D		DST	
57MU1	6C	12	G,3A	SPC	15,18	D 15, 18	EMU-D	0- 15	DST	
58MA1	6C	12	G,3A	ABX	12- 40	C150,250	EMU-D		4PI	
58MA1	6C	12	G,PA	ABX	25- 80	C150,250	EMU-D		4PI	
58MA1	6C	12	G,PT	ABX	27- 70	C150,250	EMU-D		4PI	
59CH1	6C	12	G,XD	RLY	THR- 80	C 80	TEL-D	15- 45	90	REL D TO P YLD
64KI1	6C	12	G,D	ABY	80-800	C400-800	TOF-D	45- 70	57	
65RO1	6C	12	G,3A	ABX	12- 17	C 12- 17	EMU-D		4PI	
66AR1	6C	12	G,BE7	ABX	30- 57	C 30- 57	ACT-I		4PI	
64HA3	6C	12	P,G	ABX	17- 20	D 1- 4	NAI-I		DST	
65SE1	6C	12	P,G	ABX	16- 20	D 0- 4	NAI-D		DST	

NITROGEN Z=7

A	ABUND.(1)	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
14	99.63	10.5	7.6	22.7	20.7	11.6	30.6	12.5	25.1
15	0.37	10.8	10.2	14.8	28.3	11.0	21.4	18.4	31.0

(1) ABUNDANCE DEPENDS ON SOURCE

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	DETECTOR TYPE	MIN-MAX	ANG	REMARKS
66SW1	7N	14	G,G	LFT	7	D 7	NAI-D		DST	
66KO1	7N	14	E,E/	ABX	8- 14	D 50,60	MAG-D	30- 60	180	
57LI1	7N	14	G,XP	SPC	THR- 70	C 30,70	EMU-D	5- 15	DST	
58GR1	7N	14	G,P	LFT	8	D 8	ION-D	0- 2	4PI	
60RE2	7N	14	G,XP			C330	CCH-D		4PI	
61KN1	7N	14	D,G	ABX	10- 12	D 0- 2	THR-I		4PI	
65DE2	7N	14	P,G	LFT	9	D 2	NAI-D		DST	

OXYGEN Z=8

A	ABUND.(1)	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
16	99.76	15.7	12.1	25.0	22.8	7.2	28.9	23.0	22.3
17	3.7(-2)	4.1	13.8	18.6	18.8	6.4	19.8	16.3	25.3
18	.20	8.0	15.9	15.8	25.6	6.2	12.2	21.9	29.0

(1) ABUNDANCE DEPENDS ON SOURCE

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	DETECTOR TYPE	MIN-MAX	ANG	REMARKS
65DO3	80	16	G,MU-T	ABX	13- 22	C	MGC-D		4PI	
65WY1	80	16	G,MU-T	ABX	10- 35	C 90	SCI-D		4PI	
59PA3	80	16	G,G	ABX	17	D 15,18	NAI-D	17	90	
59PE5	80	16	G,G	ABX	19- 61	C 19- 61	NAI-D	15- 61	135	
59PE5	80	16	G,G/	ABX	19- 61	C 19- 61	NAI-D	15- 61	135	
64LA5	80	16	G,G	RLX	THR- 32	C 24,32	NAI-D	2- 27	DST	
64LO3	80	16	G,G	ABX	10- 30	C 10- 30	NAI-D	10- 30	140	
65MA1	80	16	G,G/	SPC	19- 30	C 21- 31	NAI-D	4- 8	140	
61IS1	80	16	E,E/	FMF	0-115	D 90-215	MAG-D		DST	
65VA4	80	16	E,E/	ABX	10- 30	D 43- 69	MAG-D	35- 70	180	
66CR1	80	16	E,E/	FMF	6	D600-800	MAG-D		DST	
66ST2	80	16	E,E/	FMF	5- 14	D 60	MAG-D	46- 60	117	
66VA1	80	16	E,E/	FMF	10- 30	D 43- 69	MAG-D	35- 70	180	
65VA2	80	18	E,E/	ABX	2- 27	D 69	MAG-D	35- 70	180	
55SC2	80	16	G,NA	ABY	THR- 32	C 32	ACT-I		4PI	
57BA3	80	16	G,N	ABY	15- 18	C 15- 18	ACT-I		4PI	BREAKS
59SA2	80	16	G,N	NOX	THR- 22	C 15- 22	ACT-I		4PI	BREAKS
62FI2	80	16	G,N	RLX	18- 29	C 26- 32	TOF-D	2- 15		
64BE8	80	16	$G,N	NOX	17- 32	C 32	SCI-D	2- 14	DST	
65CA1	80	16	G,XN	ABX	17- 28	D 17- 28	BF3-I		4PI	BRANCH RATIOS
65GA1	80	16	G,NP	ABX	250	C300	TEL-D	90-140	DST	
65HA1	80	16	G,XN	ABX	THR- 30	C 6- 30	BF3-I		4PI	
65VE1	80	16	G,N	SPC	THR- 33	C 34	TOF-D	1- 14	DST	
66CO1	80	16	G,N	ABX	THR- 65	CTHR- 70	ACT-I		4PI	
66FI1	80	16	$G,N	NOX	THR- 70	C 10- 70	TOF-D	2- 8	DST	
66OW1	80	16	G,NG/	RLY	THR- 29	C 20- 29	SCD-D	4- 9	135	
65MO1	80	16	G,P	SPC	15- 29	C 22,40	SCD-D		90	BRANCH RATIOS
65ST2	80	16	G,P	ABX	14- 16	C 14- 16	SCD-D	2- 4	90	
66DE4	80	16	G,P	ABI	THR- 44	C 21- 44	TEL-D	3- 12	90	
66OW1	80	16	G,PG/	RLY	THR- 29	C 20- 29	SCD-D	4- 9	135	
67KO1	80	16	G,P	ABX	THR- 55	C 21- 55	TEL-D	3- 30	90	

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	DETECTOR TYPE	MIN-MAX	ANG	REMARKS
55SC2	80	16	G,T	ABY	THR- 32	C 32	ACT-I		4PI	
58MA1	80	16	G,4A	ABX	20- 40	C150,250	EMU-D	0- 90	4PI	
58MA1	80	16	G,PA	ABY	27- 80	C150,250	EMU-D	0- 90	4PI	
64TO3	80	16	G,A	ABX	9- 21	C 22	EMU-D		DST	
64TO3	80	16	G,4A	ABX	9- 21	C 22	EMU-D		DST	
65AR3	80	16	G,BE7	RLY	32- 57	C 57	ACT-I		4PI	
65BU1	80	16	G,T	THR-	50	C 50	ACT-I		4PI	
65RO1	80	16	G,A	ABX	12- 17	C 12- 17	EMU-D	1- 11	4PI	
65RO1	80	16	G,4A	ABX	12- 17	C 12- 17	EMU-D		4PI	
66AR1	80	16	G,BE7	ABX	30- 57	C 30- 57	ACT-I		4PI	
66GO2	80	16	G,T	ABX	THR- 55	CTHR- 55	ACT-I		4PI	
66VO1	80	16	G,D	ABX	THR- 50	C 20- 50	TEL-D	5- 10	90	
66EV1	80	15	P,G	SPC	5- 9	D 1- 2	NAI-D	1- 10	DST	
61TA3	80	16	P,G	ABX	12- 26	D 0- 14	NAI-D		90	
62SU2	80	16	D,G	RLX	21- 25	D 1- 5	NAI-D		90	
63SU2	80	16	D,G	ABX	21- 25	D 1- 4	NAI-D		DST	
64EA1	80	16	P,G	NOX	13- 25	D 1- 13	NAI-D		DST	
64SU1	80	16	D,G	ABX	24- 28	D 1- 5	NAI-D		DST	
66PU1	80	16	HE3,G	RLX	23- 26	D 1- 4	NAI-D	15- 26	90	
66SU1	80	16	D,G	ABX	21- 26	D 1- 6	NAI-D	0- 25	DST	
67EA1	80	16	P,G	ABX	13- 25	D 1- 14	NAI-D		DST	

FLUORINE Z=9

A	ABUND.	SEPARATION ENERGIES (MEV) G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
19	100.00	10.4	8.0	11.7	22.1	4.0	19.6	6.1	23.9

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	DETECTOR TYPE	MIN-MAX	ANG	REMARKS
64LO3	9F	19	G,G	ABX	10- 30	C 10- 30	NAI-D	10- 30	140	
66DE5	9F	19	G,N	SPC	THR-260	C260	ACT-I		DST	
66DE5	9F	19	G,N	NOX	THR-260	C260	ACT-I		DST	
55LA1	9F	19	G,P	SPC	10- 17	C 17	EMU-D	2- 6	DST	
55RE1	9F	19	G,2P	ABI	THR-400	C 80-400	ACT-I		4PI	
64SE1	9F	19	G,XP	SPC	THR- 24	C 14- 24	EMU-D	2- 15	DST	
65HA2	9F	19	G,A	SPC	THR- 31	C 31	EMU-D	5- 20	DST	

NEON Z=10

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
20	90.92	16.9	12.8	23.9	21.2	4.7	28.5	23.3	20.8
21	0.26	6.8	13.0	21.6	19.9	7.3	23.6	19.6	23.6
22	8.82	10.4	15.3	21.5	26.3	9.7	17.1	23.4	26.4

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	DETECTOR TYPE	MIN-MAX	ANG	REMARKS
61CL1	10	NE20	G,G	LFT	1- 3	D 1- 3	NAI-D	1- 3	0	
60RE2	10	NE20	G,XP			C240	CCH-D		4PI	
55RE1	10	NE	G,N17	ABI	THR-400	90-400	ACT-I		4PI	
66PA3	10	NE20	P,G	NOX	18	D 5	SCI-D		DST	
67SE1	10	NE20	P,G	ABX	16- 25	D 3- 13	NAI-D		DST	

SODIUM Z=11

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
23	100.00	12.4	8.8	17.4	24.4	10.5	23.5	19.2	24.1

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	DETECTOR TYPE	MIN-MAX	ANG	REMARKS
65WY1	11	NA23	G,MU-T	ABX	10- 35	C 90	SCI-D		4PI	
61AM1	11	NA23	G,G	LFT	1	D	NAI-D		120	
64LO3	11	NA23	G,G	ABX	10- 30	C 10- 30	NAI-D	10- 30	140	
64ME2	11	NA23	G,G	LFT	4	D 4	NAI-D	4	DST	
65BA4	11	NA23	E,E/	ABX	4	D 59	MAG-D	50- 59	180	
55RE1	11	NA23	G,N17	ABI	THR-400	C 90-400	ACT-I		4PI	
65TA1	11	NA22	P,G	NOX	7	D 0- 1	NAI-D	0- 8	90	LEVELS, I-PI
66WE1	11	NA22	P,G	SPC	9- 10	D 1- 2	NAI-D	1- 10	DST	

MAGNESIUM Z=12

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
24	78.70	16.5	11.7	26.7	23.1	9.3	29.9	24.1	20.5
25	10.13	7.3	12.1	23.0	20.1	9.9	23.9	19.1	22.6
26	11.17	11.1	14.1	21.6	26.0	10.6	18.4	23.2	24.8

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	DETECTOR TYPE	MIN-MAX	ANG	REMARKS
64DO2	12MG		G,MU-T	ABX	12- 30	C250	MGP-D	12- 30	4PI	
65DO2	12MG		G,MU-T	ABX	11- 30	C260	MGP-D	10- 30	4PI	
65WY1	12MG		G,MU-T	ABX	10- 70	C 90	SCI-D		4PI	
59LA1	12MG		G,G	LFT	10	C 13	NAI-D	0- 12	135	
58BU1	12MG	24	G,G	LFT	1	D 1	SCI-D	1	4PI	
60BU2	12MG	24	G,G	LFT	11	C	NAI-D		DST	
60BU3	12MG	24	G,G	LFT	10	C 23	NAI-D		DST	
67TI1	12MG	24	E,E/	SPC	15- 26	D 45-54	MAG-D		DST	
64FI2	12MG		G,N	RLY	18- 26	C 27- 32	TOF-D	1- 9		
65MI1	12MG		G,XN	ABX	THR- 30	CTHR- 30	BF3-I		4PI	
65MA4	12MG		G,XP	SPC	THR- 31	C 31	SCD-D	3- 14		
55RE1	12MG		G,N17	ABI	THR-400	C 80-400	ACT-I		4PI	
66HO3	12MG		G,A	SPC	THR- 31	C 31	SCD-D	2- 13	130	
64SH6	12MG	24	G,F	ABY	THR-100	C100	ACT-I		4PI	

ALUMINUM Z=13

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
27	100.00	13.1	8.3	18.2	23.7	10.1	24.4	19.4	22.4

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	DETECTOR TYPE	MIN-MAX	ANG	REMARKS
64DO2	13AL27		G,MU-T	ABX	9- 29	C250	MGP-D	9- 29	4PI	
65WY1	13AL27		G,MU-T	ABX	10- 70	C 90	SCI-D		4PI	
59PA3	13AL27		G,G	ABX	17	D 15,18	NAI-D	17	90	
60VA1	13AL27		G,G	LFT	1	C 3	NAI-D	0- 1	120	
64ME2	13AL27		G,G	LFT	4	D 4	NAI-D	4	DST	
65KH1	13AL27		G,G	LFT	2,3	D 2,3	NAI-D		DST	
65ME3	13AL27		G,G	LFT	4	D 4	NAI-D		DST	
66HO2	13AL27		G,G	LFT	1	C 1	NAI-D	0- 1	117	
66VA4	13AL27		G,G	ABI	10	D 10	NAI-D	0- 10	80	
59BA3	13AL27		E,N	ABY	THR- 36	D 10- 36	BF3-I		4PI	
64CH1	13AL27		E,P	ABX		D 4GEV	MAG-D	110-450	DST	
55BA5	13AL27		G,XN	ABY	30-200	C150-250	THR-I	30-	DST	
58BA5	13AL27		G,XN	RLY	THR- 15	C 12- 15	BF3-I		4PI	BREAKS
64AL5	13AL27		G,XN	NOX	THR- 34	C 34	THR-I	6-	DST	
64TH1	13AL27		G,N	ABX	15- 24	C 15- 24	ACT-I		4PI	
65TH2	13AL27		G,N	ABX	13- 24	C 13- 25	ACT-I		4PI	THRESHOLD
66BI1	13AL27		G,N	ABX	20-200	C 20-200	BF3-I	0- 50	4PI	
66FU1	13AL27		G,N	ABX	13- 37	D 13- 37	BF3-I		4PI	
66FU1	13AL27		G,2N	ABX	25- 37	D 25- 37	BF3-I		4PI	
57BA2	13AL27		G,XP	SPC	THR- 85	C 85	TEL-D	15- 60	DST	
58BA6	13AL27		G,XP	SPC	THR- 85	C 85,90	TEL-D	13- 40	DST	
64MA2	13AL27		G,XP	SPC	THR- 20	C 20	SCD-D	3- 9		
66LI1	13AL27		G,P	SPC	THR- 32	C 32	SCI-D	1- 20	90	
55RE1	13AL27		G,N17	ABI	THR-400	C 80-400	ACT-I		4PI	
56HE1	13AL27		G,T	RLY	THR- 31	C 31	ACT-I		4PI	
56WA1	13AL27		G,T	RLY	THR- 31	C 31	ACT-I		4PI	
57BO1	13AL27		G,A	SPC	THR- 30	C 31	EMU-D	5- 15	DST	
65HA2	13AL27		G,A	SPC	THR- 31	C 31	EMU-D	5- 20	DST	
66HO3	13AL27		G,A	SPC	THR- 31	C 31	SCD-D	2- 13	130	
65VA5	13AL27		P,G	SPC	10	D 2	NAI-D	1- 10	DST	

SILICON Z=14

A	ABUND.(1)	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
28	92.21	17.2	11.6	27.5	23.2	10.0	30.5	24.7	19.9
29	4.70	8.5	12.3	24.6	20.6	11.1	25.7	20.1	21.9
30	3.09	10.6	13.5	22.2	24.8	10.7	19.1	23.0	24.0

(1) ABUNDANCE DEPENDS ON SOURCE

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	DETECTOR TYPE	MIN-MAX	ANG	REMARKS
65WY1	14SI		G,MU-T	ABX	10- 35	C 90	SCI-D		4PI	
65SW1	14SI	28	G,G	LFT	7	D 7	NAI-D		DST	J
64RE1	14SI	29	G,G	LFT	1	D 1	NAI-D	1	90	
64BR2	14SI	28	E,E/	SPC	0-12	D 41	MAG-D		152	
66LI2	14SI	28	E,E/	LFT	2,11	D 30- 56	MAG-D		DST	
65GO1	14SI		G,P	SPC	THR- 27	C 23-27	SCD-D	3- 11	90	
66LI1	14SI		G,P	SPC	THR- 32	C 21,32	SCI-D	1- 19	90	
67GO1	14SI		G,P	ABX	THR- 29	C 11- 29	SCD-D	1-	4PI	
64UL3	14SI	28	G,P	SPC	13- 23	C 24	SCD-D	1- 11	4PI	
65BI1	14SI	28	G,P	RLX	18	D 18	SCD-D	4- 8	4PI	
65CA2	14SI	28	G,P	ABX	THR- 23	C 16- 23	SCD-D	3- 12	4PI	
65MA6	14SI	28	G,P	ABX	17- 22	D 17- 22	SCD-D	4- 12	4PI	
65HA2	14SI		G,A	SPC	THR- 31	C 31	EMU-D	5- 20	DST	
65BI1	14SI	28	G,A	RLX	18	D 18	SCD-D	6- 8	4PI	
65CA2	14SI	28	G,A	ABX	THR- 23	C 16- 23	SCD-D	3- 12	4PI	
65MA6	14SI	28	G,A	ABX	17- 22	D 17- 22	SCD-D	4- 12	4PI	
61GA1	14SI	28	P,G	ABX	16- 25	D 5- 13	NAI-D		90	
65SI1	14SI	28	P,G	ABX	16- 24	D 4- 13	NAI-D	16- 24	90	

PHOSPHORUS Z=15

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
31	100.00	12.3	7.3	17.9	22.5	9.7	23.6	17.9	20.8

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	DETECTOR TYPE	MIN-MAX	ANG	REMARKS
61BO3	15P	31	G,MU-T	ABX	11- 20	C 11- 20	ACT-I		4PI	
66HO2	15P	31	G,G	LFT	1	C 1	NAI-D	0- 1	117	
65KO1	15P	31	E,E/	FMF	1- 6	D130-180	MAG-D120-180		DST	
57BA3	15P	31	G,N	ABY	11- 14	C 11- 14	ACT-I		4PI	BREAKS
66YO1	15P	29	P,G	SPC	8- 9	D 5- 6	ACT-I		4PI	
66VA2	15P	31	P,G	SPC	8- 10	D 1- 2	NAI-D	1- 11	DST	

SULPHUR Z=16

A	ABUND.(1)	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
32	95.0	15.1	9.0	24.0	19.1	6.9	28.1	21.2	16.1
33	0.76	8.6	9.6	21.3	17.1	7.1	23.7	17.5	18.2
34	4.22	11.4	10.9	20.4	21.9	7.9	20.1	21.0	20.3
36	1.4(-2)	9.9	*	19.3	*	8.9	16.9	21.2	*

(1) ABUNDANCE DEPENDS ON SOURCE

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	DETECTOR TYPE	MIN-MAX	ANG	REMARKS
65WY1	16S		G,MU-T	ABX	10- 35	C 90	SCI-D		4PI	
65VA3	16S		G,NP	ABX	50-300	C 50-300	ACT-I		4PI	
62FI3	16S	32	G,N	RLY	16- 28	C 32	TOF-D	1- 12		
62MI5	16S	32	G,N	SPC	15- 30	C 30	EMU-D	0- 15	DST	
65TH1	16S	32	G,N	ABX	THR- 22	C 15- 22	ACT-I		4PI	
66BI1	16S	32	G,N	ABX	20-200	C 20-200	BF3-I	0- 50	4PI	
66LI1	16S		G,P	SPC	THR- 32	C 32	SCI-D	1- 20	90	
67IS1	16S		G,P	ABX	THR- 35	C 22- 35	EMU-D	3	DST	

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX		DETECTOR TYPE	MIN-MAX	ANG	REMARKS
55RI1	16S		G,D	RLY	THR- 65	C	65	CCH-I		4PI	RLY TO PROTONS
66HO3	16S		G,A	SPC	THR- 31	C	31	SCD-D	3- 13	130	
65DE1	16S	32	P,G	ABX	10- 21	D	2- 12	NAI-D	10- 22	DST	
66HO1	16S	32	P,G	SPC	10	D	1	NAI-D	1- 10	55	
65MC2	16S	34	A,G	RLY	11- 12	D	3- 4	NAI-D	0- 12	DST	
67WI1	16S	34	A,G	LFT	11- 12	D	4- 5	NAI-D	1- 12	DST	

CHLORINE Z=17

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
35	75.53	12.6	6.4	18.0	19.6	7.0	24.1	17.8	17.3
37	24.47	10.3	8.4	16.8	21.9	7.9	18.9	18.3	*

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX		DETECTOR TYPE	MIN-MAX	ANG	REMARKS
66BE3	17CL		G,G	RLX	5- 10	D	5- 10	NAI-D	5- 10	135	
66HO2	17CL	35	G,G	LFT	1-	C	1	NAI-D	0- 1	117	
57BA3	17CL	35	G,N	RLY	12- 14	C	12- 14	ACT-I		4PI	BREAKS
55ER1	17CL		G,A	ABY	THR- 31	C	32	EMU-I		4PI	

ARGON Z=18

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
36	0.34	15.3	8.5	24.2	18.6	6.6	28.3	21.2	14.9
38	6.3(-2)	11.8	10.2	20.7	20.8	7.2	20.6	20.6	18.6
40	99.6	9.9	12.5	18.2	23.0	6.8	16.4	20.6	22.8

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX		DETECTOR TYPE	MIN-MAX	ANG	REMARKS
65EH1	18AR	38	G,N	ABY	THR- 31	C	18- 31	ACT-I		4PI	
65EH1	18AR	40	G,NP	ABY	THR- 31	C	18- 31	ACT-I		4PI	

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	DETECTOR TYPE	MIN-MAX	ANG	REMARKS
55SP3	18AR40		G,P	SPC	THR- 23	C 23	EMU-D	1- 8	DST	
57KO2	18AR40		G,XP	NOX	THR- 90	C 90	CCH-D	2- 10	DST	
65RE1	18AR40		G,P	ABX	9	D 9	CCH-D	1- 6	4PI	
65RE1	18AR40		G,A	ABX	9	D 9	CCH-D	1- 12	4PI	

POTASSIUM Z=19

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
39	93.10	13.1	6.4	18.5	19.2	7.2	25.1	18.2	16.6
40	1.2(-2)	7.8	7.6	17.5	16.7	6.4	20.9	14.2	18.3
41	6.88	10.1	7.8	15.8	20.7	6.2	17.9	17.7	20.3

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	DETECTOR TYPE	MIN-MAX	ANG	REMARKS
65CO1	19K	38	G,N	ABX	THR- 70	C 12- 70	ACT-I		4PI	
65CO3	19K	39	G,N	ABX	THR- 80	C 80	ACT-I		4PI	
65CO3	19K	39	G,NP	ABX	THR- 80	C 80	ACT-I		4PI	
55SC2	19K	39	G,NA	ABY	THR- 32	C 32	ACT-I		4PI	

CALCIUM Z=20

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
40	96.97	15.7	8.3	25.0	18.8	7.0	29.3	21.5	14.7
42	0.64	11.5	10.3	19.7	20.2	6.2	19.8	20.4	18.1
43	0.15	7.9	10.7	19.8	18.3	7.6	19.4	18.2	19.9
44	2.06	11.1	12.2	20.9	23.3	8.8	19.1	21.8	21.6
46	3.3(-3)	10.4	13.8	21.5	*	11.1	17.8	23.2	*
48	0.19	9.9	15.3	22.5	*	*	17.2	24.	*

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	DETECTOR TYPE	MIN-MAX	ANG	REMARKS
65DO1	20CA40		G,MU-T	ABX	10- 28	C260	MGP	10- 28	4PI	
65WY1	20CA40		G,MU-T	ABX	10- 70	C 90	SCI-D		4PI	

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	DETECTOR TYPE	MIN-MAX	ANG	REMARKS
66ME3	20	CA42	G,G	LFT	2	D 2	NAI			
62BL1	20	CA40	E,E/	FMF	0- 9	D120-220	MAG-D	170-180	DST	
65CR1	20	CA40	E,E/	ABX	3- 5	D250	MAG-D		DST	
62FI3	20	CA40	G,N	RLY	16- 28	C 32	TOF-D	1- 12		
65VA3	20	CA40	G,NP	ABI	50-300	C 50-300	ACT-I		4PI	
66AN1	20	CA40	G,XN	ABX	16- 62	C 16- 62	ACT-I		4PI	
66BA1	20	CA40	G,N	ABX	15- 50	C 15- 50	BF3-I		4PI	
59KO2	20	CA40	G,P	SPC THR-	85	C 85	EMU-D	1- 15	DST	
64IS3	20	CA40	G,P	ABX THR-	34	C 18- 34	EMU-D	3- 15	DST	
57SC1	20	CA40	G,3N3P	ABX	35- 70	C 35- 70	ACT-I		4PI	
61TA2	20	CA40	P,G	RLY	18- 22	D 9- 15	NAI-D	10- 25	100	
66LE1	20	CA40	P,G	SPC	9- 11	D 1- 3	NAI-D	2- 12	55	

SCANDIUM Z=21

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
45	100.00	11.3	6.9	17.5	21.0	7.9	21.0	18.1	19.1

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	DETECTOR TYPE	MIN-MAX	ANG	REMARKS
66TA1	21	SC45	G,N	RLY THR-	48	C 24- 48	ACT-I		4PI	
66WA1	21	SC45	G,N	RLY THR-	300	C 50-300	ACT-I		4PI	
66DU2	21	SC49	P,G	SPC	10- 11	D 1	NAI-D	1- 12	DST	
67CH1	21	SC49	P,G	LFT	12	D 2	SCD-D		90	

TITANIUM Z=22

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
46	7.93	13.1	10.4	22.9	20.7	8.0	22.6	21.7	17.2
47	7.28	8.9	10.5	22.0	18.4	9.0	22.1	19.3	18.7
48	73.94	11.6	11.4	22.4	22.6	9.4	20.5	22.1	19.9
49	5.51	8.1	11.3	21.8	20.4	10.1	19.8	19.6	20.8
50	5.34	10.9	12.2	22.0	24.0	10.7	19.1	22.3	21.8

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	DETECTOR TYPE	DETECTOR MIN-MAX	ANG	REMARKS
66BE3	22TI		G,G	RLX	5- 10	D 5- 10	NAI-D	5- 10	135	
64AL5	22TI		G,XN	NOX	THR- 34	C 34	THR-I	6-	DST	
67CO1	22TI		G,XN	ABX	12- 24	C 24	BF3-I		4PI	
66TA1	22TI	46	G,NP	RLY	THR- 48	C 24- 48	ACT-I	0- 1	4PI	

VANADIUM Z=23

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
50	0.24	9.3	7,9	19.2	19.8	9.9	20.9	16.1	19.3
51	99.76	11.0	8.1	18.7	22.6	10.3	20.4	19.0	20.2

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	DETECTOR TYPE	DETECTOR MIN-MAX	ANG	REMARKS
56HE2	23V	51	G,2P	RLY	THR- 31	C 31	ACT-I		4PI	
58HA1	23V	51	G,XP	SPC	THR- 30	C 30	EMU-D	2- 20	DST	
56HE2	23V	51	G,A	RLY	THR- 31	C 31	ACT-I		4PI	

CHROMIUM Z=24

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
50	4.31	12.9	9.6	23.2	20.3	8.6	23.3	21.2	16.3
52	83.76	12.0	10.5	22.4	21.8	9.4	21.3	21.6	18.6
53	9.55	7.9	11.1	21.0	18.8	9.1	20.0	18.5	20.1
54	2.38	9.7	12.	19.7	22.1	7.9	17.6	20.9	22.

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	DETECTOR TYPE	MIN-MAX	ANG	REMARKS
64CO3	24CR		G,N	ABI	THR- 80	C 10- 80	BF3-I		4PI	
64AL5	24CR		G,XN	NOX	THR- 34	C 34	THR-I	6-	DST	

MANGANESE Z=25

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
55	100.00	10.2	8.1	17.2	21.2	7.9	19.2	17.8	20.

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	DETECTOR TYPE	MIN-MAX	ANG	REMARKS
64CO3	25MN55		G,N	ABI	THR- 80	C 10- 80	BF3-I		4PI	
66WA1	25MN55		G,3N	RLY	THR-300	C100-300	ACT-I		4PI	
66WA1	25MN55		G,4P7N	RLY	THR-300	C100-300	ACT-I		4PI	
66VU1	25MN53		P,G	RLY	7- 9	D 1- 2	NAI-D	4- 9	90	

IRON Z=26

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
54	5.82	13.6	8.9	22.9	19.7	8.4	24.1	20.9	15.4
56	91.66	11.2	10.2	20.9	20.3	7.6	20.5	20.4	18.3
57	2.19	7.6	10.6	19.6	18.2	7.3	18.8	17.9	19.6
58	0.33	10.0	12.0	19.4	22.0	7.6	17.7	20.6	21.4

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	DETECTOR TYPE	MIN-MAX	ANG	REMARKS
64CO3	26	FE	G,N	ABI	THR- 80	C 10- 80	BF3-I		4PI	
66WA1	26	FE	G,5PXN	RLY	THR-250	C100-250	ACT-I		4PI	
66WA1	26	FE	G,PXN	RLY	THR-250	C100-250	ACT-I		4PI	
66BE4	26	FE56	G,N	ABX	11	C 13	TOF-D		135	
66BE1	26	FE	N,G	SPC	15	D 7	NAI-D	8- 18		

COBALT Z=27

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
59	100.00	10.5	7.4	16.6	20.3	7.0	19.0	17.4	19.3

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	DETECTOR TYPE	MIN-MAX	ANG	REMARKS
65WY1	27	CO59	G,MU-T	ABX	10- 35	C 90	SCI-D		4PI	
64CO3	27	CO59	G,N	ABI	THR- 80	C 10- 80	BF3-I		4PI	
65BA3	27	CO59	G,XN	ABX	THR- 28	C 10- 30	BF3-I		4PI	
67HU1	27	CO59	G,N	ABX	11	D 11	BF3-I		4PI	
57RO1	27	CO59	G,P	SPC	15,18	D 15,18	EMU-D	3- 7	DST	
56HE1	27	CO59	G,T	RLY	THR- 31	C 31	ACT-I		4PI	
56WA1	27	CO59	G,T	RLY	THR- 31	C 31	ACT-I		4PI	
66WA1	27	CO59	G,2P5N	RLY	THR-150	C150	ACT-I		4PI	

NICKEL Z=28

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
58	67.88	12.2	8.2	21.1	17.7	6.4	22.5	19.6	14.2
60	26.23	11.4	9.5	20.1	19.2	6.3	20.4	20.0	16.9
61	1.19	7.8	9.9	19.3	17.0	6.5	19.2	17.4	18.1
62	3.66	10.6	11.1	19.5	21.0	7.0	18.4	20.5	19.8
64	1.08	9.7	12.5	19.1	22.9	8.0	16.5	21.0	*

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	DETECTOR TYPE	MIN-MAX	ANG	REMARKS
65WY1	28NI		G,MU-T	ABX	10- 35	C 90	SCI-D		4PI	
65GI1	28NI		G,G/	RLY	8	D 8	NAI-D	8	135	
66BE3	28NI		G,G	RLX	5- 10	D 5- 10	NAI-D	5- 10	135	
67ES1	28NI	62	G,G/	ABX	8	D 8	NAI-D		DST	
66DU1	28NI	58	E,E/	FMF	1	D 45- 65	MAG-D		DST	
66DU1	28NI	60	E,E/	FMF	1	D 45- 65	MAG-D		DST	
66DU1	28NI	62	E,E/	FMF	1	D 45- 65	MAG-D		DST	
64CO3	28NI		G,N	ABI	THR- 80	C 10- 80	BF3-I		4PI	
65BA3	28NI		G,XN	ABX	THR- 28	C 10- 30	BF3-I		4PI	
57BA2	28NI		G,XP	SPC	THR- 85	C 85	TEL-D	15- 60	DST	
58BA6	28NI		G,XP	SPC	THR- 85	C 85	TEL-D	13- 40	DST	
64MA2	28NI	58	G,XP	SPC	THR- 22	C 22	SCD-D	3- 9		
57BO1	28NI		G,A	SPC	THR- 30	C 31	EMU-D	5- 15	DST	
66HO3	28NI		G,A	SPC	THR- 31	C 31	SCD-D	3- 14	130	
67KN1	28NI		G,T	RLY	THR- 49	C 36,49	ACT-I		4PI	
66BE1	28NI		N,G	SPC	16	D 7	NAI-D	8- 18		

COPPER Z=29

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
63	69.09	10.8	6.1	16.1	18.9	5.8	19.7	16.8	17.2
65	30.91	9.9	7.4	15.5	20.7	6.8	17.8	17.1	19.9

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	DETECTOR TYPE	MIN-MAX	ANG	REMARKS
65WY1	29CU		G,MU-T	ABX	10- 35	C 90	SCI-D		4PI	
55BU1	29CU		G,G	RLX	0- 3	C 3	NAI-D		90	
57BE1	29CU		G,G	ABX	13- 21	C 18- 22	ACT-I		90	
59PE5	29CU		G,G	ABX	19- 61	C 19- 61	NAI-D	15- 61	135	
66BE3	29CU		G,G	RLX	5- 10	D 5- 10	NAI-D	5- 10	135	
59BA3	29CU		E,N	ABY	THR- 36	D 10- 36	BF3-I		4PI	
64CH1	29CU		E,P	ABX		D 4GEV	MAG-D	110-450	DST	
55MC1	29CU		G,XN	RLY	THR- 22	C 22	NAI-I		90	
64AL5	29CU		G,XN	NOX	THR- 34	C 34	THR-I	6-	DST	
64CO3	29CU		G,N	ABI	THR- 80	C 10- 80	BF3-I		4PI	
65BA3	29CU		G,XN	ABX	THR- 28	C 10- 30	BF3-I		4PI	
64MA2	29CU	63	G,XP	SPC	THR- 17	C 17	SCD-D	3- 9		
66VO1	29CU	64	G,P	RLY	THR- 52	C 23- 52	TEL-D	4- 5	90	
56HE1	29CU		G,T	RLY	THR- 31	C 31	ACT-I		4PI	
56WA1	29CU		G,T	RLY	THR- 31	C 31	ACT-I		4PI	
57BO1	29CU		G,A	SPC	THR- 30	C 31	EMU-D	5- 15	DST	
65ME2	29CU		G,A	SPC	THR- 35	C 35	SCD-D	5- 26	90	
66HO3	29CU	63	G,A	ABY	THR- 31	C 31	SCD-D	3- 14	130	
66VO1	29CU	64	G,D	RLY	THR- 52	C 23- 52	TEL-D	4- 6	90	

ZINC Z=30

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
64	48.89	11.9	7.7	19.0	16.7	4.0	21.0	18.6	13.8
66	27.81	11.0	8.9	18.2	18.3	4.6	19.0	18.8	16.4
67	4.11	7.1	8.9	17.4	15.7	4.8	18.1	16.0	17.3
68	18.57	10.2	10.0	17.7	19.8	5.3	17.3	19.1	18.5
70	0.62	9.2	*	17.2	*	5.9	15.7	19.5	*

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	TYPE	DETECTOR MIN-MAX	ANG	REMARKS
66BE3	30	ZN	G,G	RLX	5- 10	D 5- 10	NAI-D	5- 10	135	
65VA3	30	ZN	G,NP	ABI	50-300	C 50-300	ACT-I		4PI	
67C01	30	ZN	G,XN	ABX	12- 24	C 24	BF3-I		4PI	
57EL1	30	ZN64	G,2N	RLY	THR- 30	C 32	ACT-I		4PI	
57EL1	30	ZN66	G,NP	ABX	22- 30	C 32	ACT-I		4PI	
64C03	30	ZN66	G,N	ABI	THR- 80	C 10- 80	BF3-I		4PI	
66IV1	30	ZN67	G,P	ABX	THR- 28	C 12- 28	ACT-I		4PI	
57EL1	30	ZN68	G,P	ABX	13- 30	C 32	ACT-I		4PI	
66HO3	30	ZN	G,A	SPC	THR- 31	C 31	SCD-D	3- 14	130	

GALLIUM Z=31

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
69	60.4	10.3	6.6	15.4	18.0	4.5	16.6	16.9	16.6
71	39.6	9.6	7.9	15.1	19.7	5.3	17.0	17.1	*

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	TYPE	DETECTOR MIN-MAX	ANG	REMARKS
64C03	31	GA	G,N	ABI	THR- 80	C 10- 80	BF3-I		4PI	
65BA3	31	GA	G,XN	ABX	THR- 28	C 10- 30	BF3-I		4PI	

GERMANIUM Z=32

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
70	20.52	11.5	8.5	18.6	17.6	4.1	20.	18.9	15.1
72	27.43	10.7	9.7	18.2	19.1	5.0	18.2	19.1	17.6
73	7.76	6.8	10.0	17.3	16.7	5.3	17.5	16.5	18.4
74	36.54	10.1	11.0	18.2	20.8	6.3	17.0	20.2	19.9
76	7.76	9.4	*	18.4	*	7.5	16.9	20.8	*

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	DETECTOR TYPE	MIN-MAX	ANG	REMARKS
64CO3	32	GE	G,N	ABI	THR- 80	C 10- 80	BF3-I		4PI	
56HE2	32	GE73	G,A	RLY	THR- 31	C 31	ACT-I		4PI	

ARSENIC Z=33

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
75	100.00	10.2	6.9	15.4	19.4	5.3	18.3	17.1	17.9

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	DETECTOR TYPE	MIN-MAX	ANG	REMARKS
64SH5	33	AS75	G,G	LFT	1	D 1	NAI-D		122	
67LA1	33	AS75	G,G	LFT	1	D 1	NAI-D		DST	
56SU1	33	AS75	G,N	RLY	THR-320	C140,320	ACT-I		4PI	
56SU1	33	AS75	G,3N	RLY	THR-320	C140,320	ACT-I		4PI	
64CO3	33	AS75	G,N	ABI	THR- 80	C 10- 80	BF3-I		4PI	
65FI1	33	AS75	G,XN	ABX	10- 25	C 10- 25	BF3-I		4PI	
67HU1	33	AS75	G,N	ABX	11	D 11	BF3-I		4PI	
56SU1	33	AS75	G,2P	RLY	THR-320	C140,320	ACT-I		4PI	
56SU1	33	AS75	G,N2P	RLY	THR-320	C140,320	ACT-I		4PI	
56SU1	33	AS75	G,3N2P	RLY	THR-320	C140,320	ACT-I		4PI	
56SU1	33	AS75	G,3N4P	RLY	THR-320	C140,320	ACT-I		4PI	
56SU1	33	AS75	G,4N5P	RLY	THR-320	C140,320	ACT-I		4PI	
56SU1	33	AS75	G,5N2P	RLY	THR-320	C140,320	ACT-I		4PI	
56SU1	33	AS75	G,5N5P	RLY	THR-320	C140,320	ACT-I		4PI	
56SU1	33	AS75	G,7N2P	RLY	THR-320	C140,320	ACT-I		4PI	
56SU1	33	AS75	G,7N4P	RLY	THR-320	C140,320	ACT-I		4PI	
56SU1	33	AS75	G,8N6P	RLY	THR-320	C140,320	ACT-I		4PI	
56SU1	33	AS75	G,10N4P	RLY	THR-320	C140,320	ACT-I		4PI	
56SU1	33	AS75	G,14N6P	RLY	THR-320	C140,320	ACT-I		4PI	

SELENIUM Z=34

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
74	0.87	12.1	8.6	19.3	17.2	4.1	20.7	19.4	14.2
76	9.02	11.2	9.5	19.3	18.9	5.1	19.2	19.8	16.4
77	7.58	7.4	9.6	18.7	16.1	5.7	18.6	17.0	17.3
78	23.52	10.5	10.4	18.9	20.1	6.0	17.9	20.1	18.4
80	49.82	9.9	11.4	18.7	21.5	7.0	16.9	20.4	*
82	9.19	9.3	*	18.8	*	*	16.0	21.2	*

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	TYPE	DETECTOR MIN-MAX	ANG	REMARKS
66BE3	34	SE	G,G	RLX	5- 10	D 5- 10	NAI-D	5- 10	135	
60DE2	34	SE76	G,G	LFT	1	D 1				

BROMINE Z=35

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
79	50.54	10.7	6.3	15.8	18.7	5.5	19.0	16.9	16.7
81	49.46	10.2	7.5	15.9	20.2	6.5	18.0	17.4	18.9

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	TYPE	DETECTOR MIN-MAX	ANG	REMARKS
66LA1	35	BR79	G,G	LFT	0- 1	D 0- 1	NAI-D	0- 1	123	
55SC2	35	BR81	G,A	ABY THR- 32		C 32	ACT-I		4PI	

KRYPTON Z=36

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
78	0.35	11.9	8.2	19.6	16.9	4.4	20.9	18.9	13.5
80	2.27	11.5	9.1	19.6	18.2	5.1	19.9	19.8	15.4
82	11.56	11.0	9.9	19.5	19.6	6.0	18.8	20.1	17.4
83	11.55	7.5	9.8	19.1	17.2	6.5	18.5	17.4	18.2
84	56.90	10.5	10.7	19.4	21.0	7.1	18.0	20.3	19.4
86	17.37	9.8	11.9	19.2	*	8.1	17.0	20.9	*

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	TYPE	DETECTOR MIN-MAX	ANG	REMARKS
66BE2	36	KR82	G,G	LFT	1	C 1	NAI-D	0- 2	113	

RUBIDIUM Z=37

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
85	72.15	10.5	7.0	16.5	19.6	6.6	19.	17.6	17.7
87	27.85	9.9	8.6	17.1	21.8	8.0	18.6	18.5	20.5

NO DATA

STRONTIUM Z=38

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
84	0.56	12.	8.	20.2	17.9	5.2	21.	19.6	14.6
86	9.86	11.5	9.6	20.	19.4	6.3	20.0	20.1	16.6
87	7.02	8.4	9.4	20.1	17.4	7.3	20.0	18.1	18.0
88	82.56	11.1	10.6	20.7	21.3	7.9	19.5	20.6	19.2

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	TYPE	DETECTOR MIN-MAX	ANG	REMARKS
64BE7	38	SR88	G,G	LFT	2	D 2		D		

YTTRIUM Z=39

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
89	100.00	11.5	7.1	18.1	19.9	7.9	20.7	18.2	17.7

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	TYPE	DETECTOR MIN-MAX	ANG	REMARKS
66WA1	39	Y 89	G,2N	RLY	THR-280	C150,280	ACT-I		4PI	

ZIRCONIUM Z=40

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
90	51.46	12.0	8.4	20.6	18.8	6.7	21.	19.9	15.5
91	11.23	7.2	8.7	18.6	14.9	5.4	19.2	15.6	16.2
92	17.11	8.6	9.4	15.7	17.2	3.0	15.8	17.4	17.1
94	17.40	8.2	10.3	15.9	18.5	3.8	14.9	17.8	18.9
96	2.80	7.8	11.	16.1	20.9	4.9	14.3	18.5	21.2

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	TYPE	DETECTOR MIN-MAX	ANG	REMARKS
66BE3	40ZR		G,G	RLX	5- 10	D 5- 10	NAI-D	5- 10	135	
65CO1	40ZR90		G,N	ABX	THR- 70	C 12- 70	ACT-I		4PI	
66OB1	40ZR90		P,G	RLX	11- 14	D 2- 6	NAI-D	0- 14	0,90	

NIOBIUM Z=41

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
93	100.00	8.8	6.0	13.4	15.7	2.0	16.6	14.7	15.4

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	TYPE	DETECTOR MIN-MAX	ANG	REMARKS
67HU1	41NB93		G,N	ABX	9- 11	D 9- 11	BF3-I		4PI	
66WA1	41NB93		G,2P4N	RLY	THR-280	C150,280	ACT-I		4PI	

MOLYBDENUM Z=42

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
92	15.84	12.6	7.3	20.8	16.9	5.	22.8	19.5	12.6
94	9.04	9.7	8.5	16.6	15.4	2.1	17.7	17.4	14.5
95	15.72	7.4	8.7	16.2	14.2	2.2	17.1	15.9	15.1
96	16.53	9.2	9.3	16.5	16.6	2.8	16.5	17.8	16.1
97	9.46	6.8	9.2	16.1	15.2	2.8	16.0	16.1	16.5
98	23.78	8.6	9.8	16.3	17.4	3.3	15.5	17.9	17.3
100	9.63	8.3	11.	15.5	18.2	3.2	14.2	18.	19.

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	DETECTOR TYPE	DETECTOR MIN-MAX	ANG	REMARKS
66BE3	42MO		G,G	RLX	5- 10	D 5- 10	NAI-D	5- 10	135	
57EL1	42MO92		G,NP	RLY	THR- 32	C 32	ACT-I		4PI	
65CO1	42MO92		G,N	RLX	THR- 70	C 12- 70	ACT-I		4PI	
57EL1	42MO92		G,P	RLY	THR- 32	C 32	ACT-I		4PI	

RUTHENIUM Z=44

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
96	5.51	10.1	7.3	17.4	14.2	1.7	*	17.3	12.2
98	1.87	10.3	8.	17.1	15.4	2.2	18.3	17.7	14.0
99	12.72	7.5	8.4	14.4	14.6	2.3	17.7	15.8	14.7
100	12.62	9.7	9.2	16.9	16.6	2.9	17.1	18.1	15.7
101	17.07	6.8	9.4	16.4	14.8	2.8	16.5	16.0	16.6
102	31.61	9.2	10.1	14.1	14.4	3.4	16.0	18.6	17.5
104	18.58	8.9	10.5	16.7	19.5	4.3	15.1	19.	19.

NO DATA

RHODIUM Z=45

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
100	100.00	9.3	6.2	13.9	15.6	3.1	16.8	15.4	16.3

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX		DETECTOR TYPE	ANG MIN-MAX	REMARKS
59IK1	45	RH103	G,G/	ABX	1	D	1	ACT-I	4PI	
65KR1	45	RH103	G,G/	RLY	7- 18	C	7- 18	ACT-I	4PI	ISOMER YIELD
65KR1	45	RH103	E,E/	RLY	7- 18	D	7- 18	ACT-I	4PI	ISOMER YIELD
67HU1	45	RH103	G,N	ABX	10,11	D	10,11	BF3-I	4PI	
65KR1	45	RH103	G,2P	ABX	15- 40	C	15- 40	ACT-I	4PI	

PALLADIUM Z=46

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
102	0.96	10.4	7.8	17.4	15.2	2.1	19.	17.7	13.3
104	10.97	10.0	8.7	17.0	16.4	2.6	17.6	18.0	14.9
105	22.23	7.1	8.8	16.6	14.2	2.9	17.1	15.8	15.7
106	27.33	9.5	9.3	16.8	17.6	3.2	16.6	18.4	16.4
108	26.71	9.2	10.0	16.6	18.5	3.9	15.8	18.5	17.8
110	11.81	8.8	11.	16.4	19.6	4.4	15.0	18.7	19.2

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX		DETECTOR TYPE	ANG MIN-MAX	REMARKS
67KN1	46	PD	G,T	RLY	THR- 49	C	36,49	ACT-I	4PI	

SILVER Z=47

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
107	51.35	9.5	5.8	13.9	16.4	2.8	17.	15.4	15.1
109	48.65	9.2	6.5	13.8	17.3	3.3	16.5	15.8	16.4

REF	NUCLIDE Z A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	DETECTOR TYPE	DETECTOR MIN-MAX	ANG	REMARKS
65WY1	47AG	G,MU-T	ABX	10- 35	C 90	SCI-D		4PI	
58BO1	47AG	G,G/	ABX	6- 28	C 6- 28	ACT-I		4PI	
66CA1	47AG107	G,G/	ABI	0- 2	C 0- 2	ACT-I		4PI	
66CA1	47AG109	G,G/	ABI	0- 2	C 0- 2	ACT-I		4PI	
67HU1	47AG	G,N	ABX	10,11	D 10,11	BF3-I		4PI	
56WA1	47AG	G,T	RLY	THR- 31	C 31	ACT-I		4PI	
65ME2	47AG	G,A	SPC	THR- 35	C 35	SCD-D	5- 26	90	
66WI1	47AG107	G,T	ABX	THR- 56	C 31- 56	ACT-I		4PI	
55ER1	47AG109	G,A	ABY	THR- 31	C 32	ACT-I		4PI	
55SC2	47AG109	G,A	ABY	THR- 32	C 32	ACT-I		4PI	
59RO3	47AG109	G,A	ABX	15- 25	C 15- 25	ACT-I		4PI	

CADMIUM Z=48

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
106	1.22	11.	7.	17.2	14.6	1.6	19.	17.4	12.3
108	0.88	10.3	8.1	17.	15.7	2.3	18.3	17.7	13.9
110	12.39	9.9	8.9	16.9	16.9	2.9	17.2	18.1	15.4
111	12.75	7.0	9.1	16.6	14.6	3.3	16.8	15.9	16.2
112	24.07	9.4	9.7	16.8	17.9	3.5	16.4	18.5	16.8
113	12.26	6.5	9.7	16.5	15.6	3.9	15.9	16.2	17.6
114	28.86	9.0	10.3	16.8	18.9	4.1	15.6	18.8	18.3
116	7.58	8.7	11.2	*	16.6	4.9	14.7	18.7	*

REF	NUCLIDE Z A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	DETECTOR TYPE	DETECTOR MIN-MAX	ANG	REMARKS
55BU1	48CD	G,G	RLX	0- 3	C 3	NAI-D		90	
65GI1	48CD	G,G/	RLY	8	D 8	NAI-D	8	135	
66BE3	48CD	G,G	RLX	5- 10	D 5- 10	NAI-D	5- 10	135	
66CA1	48CD111	G,G/	ABI	0- 2	C 0- 2	ACT-I		4PI	
66MI1	48CD112	G,G	ABX	8	D 8	NAI-D	0- 8	DST	

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	DETECTOR TYPE	MIN-MAX	ANG	REMARKS
65CH1	48	CD111	E,E/	ABX	1	D 1- 2	ACT-I		4PI	
55MC1	48	CD	G,XN	RLY	THR- 22	C 22	NAI-I		90	
59KU2	48	CD112	G,P	ABX	THR- 28	C 15- 28	ACT-I		4PI	
59KU2	48	CD113	G,P	ABX	THR- 28	C 15- 28	ACT-I		4PI	
59KU2	48	CD114	G,P	ABX	THR- 28	C 15- 28	ACT-I		4PI	
59KU2	48	CD116	G,P	ABX	THR- 28	C 15- 28	ACT-I		4PI	

INDIUM Z=49

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
113	4.28	9.4	6.1	13.9	16.8	3.0	17.3	15.5	15.7
115	95.72	9.0	6.8	13.9	17.9	3.8	16.3	15.9	17.1

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	DETECTOR TYPE	MIN-MAX	ANG	REMARKS
55BU1	49	IN	G,G	RLX	0- 3	C 3	NAI-D		90	
66VE1	49	IN113	G,G/	ABX	1	D 0- 1	ACT-I		4PI	
65KR1	49	IN115	G,G/	RLY	7-18	C 7- 18	ACT-I		4PI	ISOMER YIELD
66VE1	49	IN115	G,G/	ABX	1	D 0- 1	ACT-I		4PI	
65CH1	49	IN115	E,E/	ABX	1	D 1- 2	ACT-I		4PI	
65KR1	49	IN115	E,E/	RLY	7- 18	D 7- 18	ACT-I		4PI	ISOMER YIELD
67HU1	49	IN115	G,N	ABX	10,11	D 10,11	BF3-I		4PI	
57RO2	49	IN	G,P	SPC	15,18	D 15,18	EMU-D	2- 7	DST	
56HE2	49	IN115	G,2P	RLY	THR- 31	C 31	ACT-I		4PI	
65ME2	49	IN	G,A	SPC	THR- 35	C 35	SCD-D	5- 26	90	
56HE2	49	IN115	G,A	RLY	THR- 31	C 31	ACT-I		4PI	

TIN Z=50

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
112	0.96	11.1	7.8	17.1	15.0	1.8	*	17.6	12.9
114	0.66	10.3	8.5	14.3	15.3	2.6	18.1	18.0	14.6
115	0.35	7.5	8.7	17.0	14.4	3.2	17.9	16.1	15.6
116	14.30	9.6	9.3	17.1	17.4	3.4	17.1	18.3	16.1
117	7.61	6.9	9.5	16.8	15.3	3.8	16.5	16.2	16.9
118	24.03	9.3	10.0	17.1	18.5	4.1	16.3	18.8	17.5
119	8.58	6.5	9.9	16.8	16.3	4.4	15.8	16.5	18.2
120	32.85	9.1	10.8	17.1	19.6	4.8	15.6	19.0	19.0
122	4.72	8.8	11.6	17.3	20.8	5.7	15.0	20.	*
124	5.94	8.5	12.	18.	*	*	14.4	20.4	*

REF	NUCLIDE Z A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	DETECTOR TYPE	DETECTOR MIN-MAX	ANG	REMARKS
66BE3	50SN	G,G	RLX	5- 10	D 5- 10	NAI-D	5- 10	135	
66HR1	50SN118	G,G	LFT	1	D 1	NAI-D	1	90	
66HR1	50SN120	G,G	LFT	1	D 1	NAI-D	1	90	
64AL5	50SN	G,XN	NOX	THR- 34	C 34	THR-I	6-	DST	

ANTIMONY Z=51

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
121	57.25	9.3	5.8	12.9	17.1	3.1	16.3	14.9	16.6
123	42.75	9.0	6.6	13.1	18.	4.1	15.8	15.4	18.

REF	NUCLIDE Z A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	DETECTOR TYPE	DETECTOR MIN-MAX	ANG	REMARKS
66BE3	51SB	G,G	RLX	5- 10	D 5- 10	NAI-D	5- 10	135	
64SH5	51SB123	G,G	LFT	1	D 1	NAI-D		122	
67HU1	51SB	G,N	ABX	10,11	D 10,11	BF3-I		4PI	
55ER1	51SB121	G,A	ABY	THR- 31	C 32	ACT-I		4PI	
56HE2	51SB121	G,A	RLY	THR- 31	C 31	ACT-I		4PI	

TELLURIUM Z=52

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
120	8.9(-2)	10.3	7.2	15.8	13.9	0.3	18.	16.8	12.3
122	2.46	10.1	8.0	15.8	15.2	1.1	17.0	17.3	13.8
123	0.87	6.9	8.1	15.7	13.0	1.5	17.0	15.0	14.5
124	4.61	9.4	8.6	15.9	16.2	1.8	16.4	17.6	15.1
125	6.99	6.6	8.7	15.7	14.0	2.2	16.0	15.2	15.8
126	18.71	9.1	9.1	15.8	17.2	.5	15.7	17.9	16.4
128	31.79	8.8	9.6	15.7	18.0	3.2	15.1	18.0	17.5
130	34.48	8.4	10.1	15.6	18.7	3.7	14.5	18.0	18.5

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	TYPE	DETECTOR MIN-MAX	ANG	REMARKS
66BE3	52	TE	G,G	RLX	5- 10	D 5- 10	NAI-D	5- 10	135	
65AK1	52	TE124	G,G	LFT	1	D 1	NAI-D		100	WIDTH
66ME1	52	TE125	G,G	LFT	1	D 1	SCD-D	1	DST	

IODINE Z=53

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
127	100.00	9.1	6.2	13.4	16.3	2.2	16.2	15.4	15.3

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	TYPE	DETECTOR MIN-MAX	ANG	REMARKS
66FR1	53	I 127	G,G	LFT	1	D 1	SCD-D	1	140	
66BR1	53	I 127	G,N	ABX	THR- 33	D 8- 33	BF3-I		4PI	
66BR1	53	I 127	G,2N	ABX	THR- 33	D 8- 33	BF3-I		4PI	
67HU1	53	I 127	G,N	ABX	10,11	D 10,11	BF3-I		4PI	
59BO1	53	I 127	G,P	ABX	15,18	D 15,18	SCI-D	2- 12	4PI	

XENON Z=54

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
124	0.10	10.0	7.0	16.5	14.1	0.5	*	16.7	11.7
126	0.09	10.0	7.6	16.0	14.9	1.3	17.9	17.2	13.2
128	1.92	9.6	8.2	15.9	15.7	1.8	16.8	17.3	14.4
129	26.44	6.9	8.3	15.7	13.6	2.1	16.6	15.1	15.0
130	4.08	9.3	8.7	15.9	16.5	2.3	16.2	17.6	15.5
131	21.18	6.6	8.8	15.7	14.4	2.5	15.9	15.3	16.0
132	26.89	8.9	9.1	15.7	17.2	2.7	15.5	17.7	16.5
134	10.44	8.5	9.5	15.6	17.9	3.2	15.0	17.8	17.5
136	8.87	7.9	10.0	15.4	*	3.6	14.4	17.8	*

NO DATA

CESIUM Z=55

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
133	100.00	9.0	6.1	13.2	16.2	2.1	16.2	15.1	15.3

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	DETECTOR TYPE	ANG MIN-MAX	REMARKS
67HU1	55CS	133	G,N	ABX	10,11	D 10,11	BF3-I	4PI	
59BO1	55CS	133	G,P	ABX	15,18	D 15,18	SCI-D	2- 12 4PI	

BARIUM Z=56

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
130	0.10	10.	7.	16.1	14.0	0.6	18.	16.8	12.0
132	9.7(-2)	9.6	7.6	15.7	14.6	0.9	17.2	16.9	13.1
134	2.42	9.2	8.0	15.7	15.4	1.4	16.6	17.1	14.2
135	6.59	7.2	8.5	15.7	13.6	2.0	16.4	15.2	14.8
136	7.81	9.2	8.7	15.9	16.3	2.3	16.4	17.7	15.6
137	11.32	6.9	9.0	16.2	14.8	2.7	16.2	15.6	16.0
138	71.66	8.5	8.9	15.7	16.8	2.8	15.5	17.6	16.6

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	DETECTOR TYPE	ANG MIN-MAX	REMARKS
64AL5	56BA		G,XN	NOX	THR- 34	C 34	THR-I	6-	DST
59HA2	56BA		G,A	SPC	THR- 30	C 30	EMU-D	2- 5	DST

LANTHANUM Z=57

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
138	8.9(-2)	7.	6.0	13.7	13.9	2.3	16.6	13.0	15.0
139	99.91	8.8	6.2	13.2	16.0	2.1	16.	14.8	15.1

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	TYPE	DETECTOR MIN-MAX	ANG	REMARKS
66BE3	57	LA139	G,G	RLX	5- 10	D 5- 10	NAI-D	5- 10	135	
67HU1	57	LA139	G,N	ABX	9- 11	D 9- 11	BF3-I		4PI	

CERIUM Z=58

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
136	0.19	10.	7.	16.0	13.8	.6	17.7	16.9	12.3
138	0.25	9.	7.	16.	14.7	1.2	17.3	16.8	13.1
140	88.48	9.0	8.0	16.	15.0	1.4	16.6	16.8	14.2
142	11.07	7.2	8.9	12.1	14.4	-1.4	12.6	15.7	15.9

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	TYPE	DETECTOR MIN-MAX	ANG	REMARKS
66BE3	58	CE	G,G	RLX	5- 10	D 5- 10	NAI-D	5- 10	135	
59HA2	58	CE	G,A	SPC THR-	30	C 30	EMU-D	2- 5	DST	

PRASEODYMIUM Z=59

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
141	100.00	9.4	5.2	13.3	14.3	1.	17.1	14.3	13.2

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	TYPE	DETECTOR MIN-MAX	ANG	REMARKS
61BO3	59	PR141	G,MU-T	ABX	11- 20	C 11- 20	ACT-I		4PI	
66BE3	59	PR141	G,G	RLX	5- 10	D 5- 10	NAI-D	5- 10	135	
59DI1	59	PR141	G,N	RLY	9- 30	C 30	ACT-I		4PI	REL CU63 (G,N)
66BR1	59	PR141	G,N	ABX THR-	33	D 8- 33	BF3-I		4PI	
66BR1	59	PR141	G,2N	ABX THR-	30	D 8- 33	BF3-I		4PI	
66BR1	59	PR141	G,3N	ABX THR-	30	D 8- 33	BF3-I		4PI	
66CO3	59	PR141	G,N	ABX THR-	65	CTHR- 70	ACT-I		4PI	
67HU1	59	PR141	G,N	ABX	10,11	D 10,11	BF3-I		4PI	

NEODYMIUM Z=60

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
142	27.11	9.8	7.2	15.8	13.8	0.7	17.7	16.6	12.5
143	12.17	6.1	7.5	14.2	10.8	0.7	15.9	13.4	13.1
144	23.85	7.8	8.0	12.7	13.2	-1.9	13.9	15.3	13.7
145	8.30	5.7	7.9	12.6	11.8	-1.6	13.6	13.8	14.4
146	17.22	7.6	8.6	12.8	14.2	-1.2	13.3	15.5	15.0
148	5.73	7.3	9.	12.7	15.	-0.6	12.	16.1	*
150	5.62	7.3	*	13.	*	0.3	12.3	16.	*

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE	DETECTOR	ANG	REMARKS
						MIN-MAX	TYPE MIN-MAX		
66BE3	60	ND	G,G	RLX	5- 10	D 5- 10	NAI-D	5- 10 135	
59HA2	60	ND	G,A	SPC	THR- 30	C 30	EMU-D	2- 5 DST	

SAMARIUM Z=62

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
144	3.09	10.5	6.4	16.3	12.6	0.	*	16.2	10.5
147	14.97	6.3	7.1	12.	10.4	-2.3	14.8	13.4	12.4
148	11.24	8.1	7.6	13.0	12.8	-2.0	14.5	15.3	13.0
149	13.83	5.8	7.5	12.6	11.1	-1.9	14.0	13.5	13.5
150	7.44	8.0	8.3	12.9	13.8	-1.5	13.8	15.5	14.2
152	26.72	8.2	8.6	13.6	15.3	-0.3	13.8	16.5	15.6
154	22.71	7.9	8.9	13.9	16.3	1.1	13.8	16.	*

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE	DETECTOR	ANG	REMARKS
						MIN-MAX	TYPE MIN-MAX		
66BE3	62	SM144	G,G	RLX	5- 10	D 5- 10	NAI-D	5- 10 135	
65ME1	62	SM148	G,G	LFT	1	D 1	NAI-D	DST	
65ME1	62	SM152	G,G	LFT	1	D 1	NAI-D	105	
59DI1	62	SM144	G,N	RLY	11- 30	C 22,30	ACT-I	4PI	REL CU63 (G,N)
59HA2	62	SM	G,A	SPC	THR- 30	C 30	EMU-D	1 5 DST	

EUROPIUM Z=63

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
151	47.82	7.9	4.9	10.2	12.7	-2.0	14.4	12.9	13.1
153	52.18	8.5	5.9	11.2	14.7	-0.3	14.8	14.2	14.5

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX		DETECTOR TYPE	ANG MIN-MAX	REMARKS
66AT1	63	EU153	G,G	LFT	1	D	1	SCD-D	1	
67HU1	63	EU	G,N	ABX	9- 11	D	9- 11	BF3-I		4PI

GADOLINIUM Z=64

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
152	0.20	8.	7.3	13.3	12.5	-2.2	15.0	15.3	12.2
154	2.15	8.6	7.6	13.9	14.0	-1.0	15.1	16.2	13.5
155	14.73	6.4	7.6	14.1	12.2	-0.1	15.1	14.1	14.0
156	20.47	8.5	8.0	14.1	14.8	0.2	15.0	16.2	14.7
157	15.68	6.4	8.0	14.0	13.3	0.6	14.9	14.4	15.2
158	24.87	7.9	8.4	13.8	15.4	0.7	14.3	16.0	15.9
160	21.90	6.1	*	13.3	*	0.9	13.3	16.1	*

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX		DETECTOR TYPE	ANG MIN-MAX	REMARKS
66BA3	64	GD155	G,G	LFT	1	D	1	NAI-D	1	
66ST1	64	GD155	G,G	LFT	1	D	1	NAI-D	1	

TERBIUM Z=65

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
156	5.2(-2)	10.	7.	14.	12.7	-1.4	16.5	16.	11.8
159	99.95	8.2	6.2	12.0	14.4	0.2	14.9	14.2	14.6

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX		DETECTOR TYPE	ANG MIN-MAX	REMARKS
66AT2	65	TB159	G,G	LFT	1	D	1	SCD-D		DST
66RA1	65	TB159	G,G	LFT	1	D	1	NAI-D		DST

DYSPROSIUM Z=66

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
156	5.2(-2)	7.1	*	12.9	*	0.6	12.8	15.8	*
158	9.0(-2)	9.	6.9	14.	13.3	-0.8	15.7	16.	12.5
160	2.29	8.6	7.4	13.9	13.8	-0.4	15.4	15.6	13.6
161	18.88	6.4	7.5	13.6	12.3	-0.3	15.0	13.9	14.0
162	25.53	8.2	8.0	13.6	14.5	0.0	14.6	15.7	14.9
163	24.97	6.2	8.3	13.4	13.4	0.2	14.5	14.3	15.5
164	28.18	7.7	8.5	13.4	15.4	0.5	13.9	16.0	16.

NO DATA

HOLMIUM Z=67

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
165	100.00	8.0	6.1	11.6	14.	-0.2	14.6	13.8	14.7

REF	NUCLIDE Z A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX		DETECTOR TYPE	MIN-MAX	ANG	REMARKS
66AX1	67HO165	G,G	ABX	13,16	D	13,16	NAI-D		90,135	
65AM1	67HO165	$G,XN	ABY	10- 20	C	10- 20	BF3-I		4PI	ORIENTED TARGET
66AX1	67HO165	G,N	ABX	8- 20	D	8- 20	BF3-I		4PI	
66AX1	67HO165	G,2N	ABX	8- 20	D	8- 20	BF3-I		4PI	
67HU1	67HO165	G,N	ABX	9- 11	D	9- 11	BF3-I		4PI	
66SC1	67HO165	G,P	SPC	THR- 70	C	70	TEL-D	6- 14	90,135	
66SC1	67HO165	G,D	RLY	THR- 70	C	70	TEL-D	6- 14	90,135	
66SC1	67HO165	G,T	RLY	THR- 70	C	70	TEL-D	6- 14	90,135	

ERBIUM Z=68

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
162	0.14	9.	6.	14.	12.2	-1.5	*	15.4	11.3
164	1.56	8.8	6.8	14.	12.8	-1.3	15.6	15.2	12.3
166	33.41	8.5	7.4	13.5	13.5	-0.8	15.2	15.5	13.5
167	22.94	6.4	7.5	13.4	12.3	-0.6	15.0	13.9	14.3
168	27.07	7.8	8.0	13.1	14.4	-0.5	14.2	15.3	15.0
170	14.88	7.2	8.5	12.7	*	-0.1	13.2	15.7	*

NO DATA

THULIUM Z=69

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
169	100.00	8.0	5.6	12.8	13.2	-1.1	15.	13.4	13.5

NO DATA

YTTERBIUM Z=70

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
168	0.14	9.	6.	13.	11.8	-2.1	15.9	14.8	11.0
170	3.03	8.	6.6	13.	12.2	-2.0	15.3	14.7	12.1
171	14.31	6.8	6.9	12.9	11.2	-1.6	15.	13.4	12.9
172	21.82	8.1	7.4	13.0	13.3	-1.3	14.9	15.1	13.8
173	16.13	6.5	7.6	11.4	12.4	-0.8	14.6	14.0	14.6
174	31.84	7.4	8.0	12.9	14.4	-0.5	13.9	15.1	15.1
176	12.73	6.6	8.	12.0	*	-0.7	12.5	12.7	*

NO DATA

LUTETIUM Z=71

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
175	97.41	7.8	5.5	11.0	12.8	-1.4	14.4	13.0	13.5
176	2.59	6.1	5.9	10.7	12.0	-1.6	14.0	11.7	13.9

NO DATA

HAFNIUM Z=72

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
174	0.18	*	5.8	13.	11.3	-2.6	*	14.4	10.9
176	5.20	8.	6.4	12.4	11.7	-2.4	15.0	14.3	11.9
177	18.50	6.40	6.6	12.1	10.6	-2.5	14.	12.8	12.5
178	27.14	7.6	7.3	11.9	12.4	-2.4	14.0	14.2	13.5
179	13.75	6.1	7.5	11.8	11.8	-2.1	13.7	13.4	14.0
180	35.24	7.3	7.9	12.2	13.6	-1.4	13.4	14.9	15.1

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX		DETECTOR TYPE	ANG MIN-MAX		REMARKS
61HA1	72	HF177	G,G	LFT	0- 1	D	0- 1	NAI-D	0- 1	110	

TANTALUM Z=73

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
180	1.2(-2)	6.8	5.9	11.1	11.6	-2.1	14.6	12.0	13.4
181	99.99	7.6	6.2	11.1	13.3	-1.4	14.4	13.5	14.1

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	DETECTOR TYPE	DETECTOR MIN-MAX	ANG	REMARKS
59BA3	73TA181		E,N	ABY	THR- 36	D 10- 36	BF3-I		4PI	
64AL5	73TA181		G,XN	NOX	THR- 34	C 34	THR-I	6-	DST	
67HU1	73TA181		G,N	ABX	8- 11	D 8- 11	BF3-I		4PI	
59SE2	73TA181		G,P	ABX	15,18	D 15,18	EMU-I		4PI	

TUNGSTEN (WOLFRAM) Z=74

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
180	0.14	*	6.5	12.8	11.6	-2.6	*	14.4	11.7
182	26.41	8.0	7.0	13.0	12.8	-1.7	14.9	14.7	13.2
183	14.40	6.2	7.1	12.4	11.7	-1.6	14.2	13.2	13.4
184	30.64	7.4	7.7	12.1	13.1	-1.5	13.6	14.6	14.3
186	28.41	7.2	8.3	12.2	14.4	-1.1	13.0	15.0	*

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	DETECTOR TYPE	DETECTOR MIN-MAX	ANG	REMARKS
66BE3	74W		G,G	RLX	5- 10	D 5- 10	NAI-D	5- 10	135	
66SH2	74W	183	G,G	LFT	1	D 1	NAI-D	1	4PI	

RHENIUM Z=75

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
185	37.07	8.	5.4	10.5	12.2	-2.3	14.	12.9	13.1
187	62.93	7.3	6.0	10.5	13.2	-1.6	13.5	13.2	14.3

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	DETECTOR TYPE	DETECTOR MIN-MAX	ANG	REMARKS
64SH5	75RE187		G,G	LFT	1	D 1	NAI-D		122	

OSMIUM Z=76

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
184	0.02	*	6.0	*	10.7	2.9	*	14.1	10.4
186	1.59	8.3	6.5	13.0	11.6	2.8	15.1	14.4	11.9
187	1.64	6.3	6.5	12.0	10.5	2.7	14.5	12.8	12.4
188	13.3	7.8	7.1	12.1	12.5	2.3	14.1	14.4	13.0
189	16.1	6.0	7.3	11.9	11.3	2.0	13.8	13.1	13.6
190	26.4	7.8	8.0	12.4	13.7	1.5	13.8	15.1	14.8
192	41.0	7.6	*	13.0	*	0.0	13.5	15.9	*

NO DATA

IRIDIUM Z=77

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
191	37.3	8.2	5.4	10.7	12.8	-2.0	14.5	13.2	13.4
193	62.7	7.8	5.8	10.9	14.0	-1.0	13.9	13.5	*

NO DATA

PLATINUM Z=78

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
190	1.3(-2)	9.	6.	13.	11.1	-3.2	15.9	14.6	11.0
192	0.78	8.	6.8	13.	12.3	-2.3	15.0	15.1	12.2
194	32.9	8.4	7.6	13.0	13.3	-1.4	14.7	15.4	13.4
195	33.8	6.1	7.6	12.9	11.8	-1.2	14.5	13.7	14.0
196	25.3	7.9	8.1	13.1	14.2	-0.8	14.0	15.5	14.8
198	7.21	7.6	8.8	13.1	15.1	0.0	13.4	15.7	*

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	TYPE	DETECTOR MIN-MAX	ANG	REMARKS
66BE3	78PT		G,G	RLX	5- 10	D 5- 10	NAI-D	5- 10	135	

GOLD Z=79

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
197	100.00	8.1	5.8	11.4	13.6	-0.9	14.8	13.8	14.0

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX		DETECTOR TYPE	MIN-MAX	ANG	REMARKS
60BAS	79	AU197	G,N	ABX	14,18	D	14,18	ACT-I		4PI	
67HU1	79	AU197	G,N	ABX	9- 11	D	9- 11	BF3-I		4PI	
59MA1	79	AU197	G,P	RLY	THR- 70	C	70	EMU-D	5- 11	90	REL D TO P YLD
59MA1	79	AU197	G,D	RLY	THR- 70	C	70	EMU-D	7- 14	90	REL D TO P YLD
65HA2	79	AU197	G,A	SPC	THR- 31	C	31	EMU-D	5- 20	DST	
65ME2	79	AU197	G,A	SPC	THR- 35	C	35	SCD-D	5- 26	90	

MERCURY Z=80

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
196	0.15	9.	6.6	13.	12.4	-1.9	16.	15.0	11.7
198	10.02	8.6	7.1	13.4	13.1	-1.3	15.3	15.2	12.9
199	16.84	6.6	7.2	13.3	11.8	-0.8	15.3	13.8	13.7
200	23.13	8.0	7.7	13.3	14.0	-0.7	14.7	15.3	14.2
201	13.22	6.2	7.6	13.0	12.7	-0.3	14.2	14.0	14.8
202	29.80	7.8	8.5	13.2	14.9	-0.1	14.0	15.4	15.
204	6.85	7.5	9.	13.5	16.1	1.	13.5	16.	*

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX		DETECTOR TYPE	MIN-MAX	ANG	REMARKS
66BE3	80	HG	G,G	RLX	5- 10	D	5- 10	NAI-D	5- 10	135	
57KN1	80	HG199	G,G	LFT	1	D	1	SCI-D	0- 1	90	
55MC1	80	HG	G,XN	RLY	THR- 22	C	22	NAI-I		90	

THALLIUM Z=81

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
203	29,5	7.7	5.7	11.2	13.4	-0.9	14.6	13.5	14.2
205	70.5	7.5	6.4	11.4	15.	0.0	14.2	14.0	15.

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX		DETECTOR TYPE	MIN-MAX	ANG	REMARKS
66BE3	81TL		G,G	RLX	5- 10	D	5- 10	NAI-D	5- 10	135	
65MO2	81TL		G,XN	ABX	10-110	C	16-110	ACT-I		4PI	
56HE2	81TL	203	G,A	RLY	THR- 31	C	31	ACT-I		4PI	
57EL2	81TL	205	G,A	ABX	THR- 32	C	32	ACT-I		4PI	

LEAD Z=82

A	ABUND.(1)	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
204	1.48	8.2	6.6	12.8	12.4	-2.0	15.2	14.4	12.3
206	23.6	8.1	7.3	13.0	13.4	-1.1	14.8	14.8	13.7
207	22.6	6.7	7.5	13.0	12.7	-0.4	14.8	14.0	14.9
208	52.3	7.4	8.0	12.9	14.5	-0.5	14.1	14.9	15.4

(1) ABUNDANCE DEPENDS ON SOURCE

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX		DETECTOR TYPE	MIN-MAX	ANG	REMARKS
55BU1	82PB		G,G	RLX	0- 3	C	3	NAI-D		90	
59CO6	82PB		G,G	ABX	6,7	D	6,7	NAI-D		30	
59PA3	82PB		G,G	ABX	17	D	15,18	NAI-D	17	90	
65GI1	82PB		G,G	LFT	5- 8	D	5- 8	NAI-D	3- 8	135	
66DE1	82PB		G,G	RLX	12- 17	D	12- 17	NAI-D		DST	
66BE3	82PB	206	G,G	RLX	5- 10	D	5- 10	NAI-D	5- 10	135	
65MC1	82PB	208	G,G	LFT	7	D	7	NAI-D		DST	
66BE3	82PB	208	G,G	RLX	5- 10	D	5- 10	NAI-D	5- 10	135	
66DO1	82PB	208	G,G	LFT	7	D	7	NAI-D		DST	
59BA3	82PB		E,N	ABY	THR- 36	D	10- 36	BF3-I		4PI	
66PE1	82PB	208	E,E/	FMF	0- 6	D	70	MAG-D		130	

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	DETECTOR TYPE	MIN-MAX	ANG	REMARKS
55BA5	82PB		G,XN	ABY	30-200	C150-250	THR-I	30-	DST	
55MC1	82PB		G,XN	RLY	THR- 22	C 22	NAI-I		90	
64AL5	82PB		G,XN	NOX	THR- 34	C 34	THR-I	6-	DST	
67HU1	82PB206		G,N	ABX	9- 11	D 9- 11	BF3-I		4PI	
66DE2	82PB207		G,N	SPC	THR- 80	C 80	CCH-D	0- 15	135	
67HU1	82PB208		G,N	ABX	9- 11	D 9- 11	BF3-I		4PI	
66BE1	82PB		N,G	SPC	14	D 7	NAI-D	8- 18		

BISMUTH Z=83

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
209	100.00	7.4	3.8	9.4	10.9	-3.1	14.3	11.2	11.8

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	DETECTOR TYPE	MIN-MAX	ANG	REMARKS
66BE3	83BI209		G,G	RLX	5- 10	D 5- 10	NAI-D	5- 10	135	
66DE1	83BI209		G,G	RLX	12- 17	D 12- 17	NAI-D		DST	
64AL5	83BI209		G,XN	NOX	THR- 34	C 34	THR-I	6-	DST	
66BE4	83BI209		G,N	ABX	7	C 11	TOF-D		135	
66DE2	83BI209		G,N	SPC	THR- 80	CTHR- 80	CCH-D	0- 15	135	
67HU1	83BI209		G,N	ABX	9- 11	D 9- 11	BF3-I		4PI	
66BE1	83BI210		N,G	SPC	11	D 7	NAI-D	8- 18		

THORIUM Z=90

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
232	100.00	6.4	7.7	10.	*	-4.1	11.4	14.	*

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX		DETECTOR TYPE	MIN-MAX	ANG	REMARKS
57KA1	90TH	232	G,XN	ABX	6- 23	C	6- 23	BF3-I		4PI	
55LA2	90TH	232	G,F	RLY	THR- 19	C	19	BF3-I		4PI	DELAYED NEUT
56KO2	90TH	232	G,F	ABX	8- 24	C	8- 24	ION-I			
56KO3	90TH	232	G,F	SPC	THR- 18	C	18	ION-D	50-100	4PI	
57SC2	90TH	232	G,F	RLY	THR- 15	C	4- 16	ACT-I		4PI	
58FA2	90TH	232	G,F	NOX	THR- 16	C	16	EMU-I		DST	
58KA2	90TH	232	G,F	ABX	5- 18	C	5- 18	ION-I		DST	
59BA4	90TH	232	G,F	RLY	THR- 20	C	6- 20	ION-I		DST	
60PR2	90TH	232	G,F	NOX	6	D	6	BF3-I		4PI	
61BO2	90TH	232	G,F	SPC	THR- 70	C	70	EMU-D			
65AL1	90TH	232	G,F	RLX	2- 7	D	6- 7	EMU-D		DST	
65CA3	90TH	232	G,F	ABY	300-1000	C	1GEV	EMU-I		4PI	
65SA1	90TH	232	G,F	SPC	THR- 8	C	8	TOF-D	1- 8	77,157	
65SO1	90TH	232	G,F	RLX	6- 7	D	6- 7			DST	TRACKS IN GLASS

URANIUM Z=92

A	ABUND.	SEPARATION ENERGIES (MEV)							
		G,N	G,P	G,T	G,HE3	G,A	G,2N	G,NP	G,2P
234	5.6(-3)	6.8	6.6	10.3	10.6	-4.8	12.7	13.3	12.0
235	0.72	5.3	6.7	10.0	9.5	-4.7	12.0	11.9	12.3
238	99.27	6.1	7.6	10.0	*	-4.3	11.4	14.0	*

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX		DETECTOR TYPE	MIN-MAX	ANG	REMARKS
59BA3	92U	238	E,N	ABY	THR- 36	D	10- 36	BF3-I		4PI	
57KA1	92U	233	G,XN	ABX	6- 23	C	6- 23	BF3-I		4PI	
57KA1	92U	238	G,XN	ABX	6- 23	C	6- 23	BF3-I		4PI	
58KA2	92U	233	G,F	ABX	5- 18	C	5- 18	ION-I		DST	
59BA4	92U	233	G,F	RLY	THR- 20	C	6- 20	ION-I		DST	
59BA4	92U	234	G,F	RLY	THR- 20	C	6- 20	ION-I		DST	

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	DETECTOR TYPE	MIN-MAX	ANG	REMARKS
59BA4	92U	235	G,F	RLY	THR- 20	C 6- 20	ION-I		DST	
59BA4	92U	236	G,F	RLY	THR- 20	C 6- 20	ION-I		DST	
55KA1	92U	238	G,F	ABX	THR- 26	C 12- 26	ACT-I		4PI	
55LA2	92U	238	G,F	RLY	THR- 19	C 19	BF3-I		4PI	DELAYED NEUT
56KO2	92U	238	G,F	ABX	8- 24	C 8- 24	ION-I			
56KO3	92U	238	G,F	SPC	THR- 18	C 18	ION-D	50-100	4PI	
57BA4	92U	238	G,F	NOX	THR- 27	C 9- 27	EMU-D		DST	
57SC2	92U	238	G,F	RLY	THR- 15	C 4- 16	ACT-I		4PI	
58BA7	92U	238	G,F	NOX	THR- 27	C 6- 27	EMU-I		DST	
58KA2	92U	238	G,F	ABX	5- 18	C 5- 18	ION-I		DST	
59BA4	92U	238	G,F	RLY	THR- 20	C 6- 20	ION-I		DST	
60PR2	92U	238	G,F	NOX	6	D 6	BF3-I		4PI	
65AL1	92U	238	G,F	RLX	6- 7	D 6- 7	EMU-D		DST	
65CA3	92U	238	G,F	ABY	300-1000	C 1GEV	EMU-I		4PI	
65HO1	92U	238	G,F	RLY	THR- 33	C 33	SCD-D100-200		90	MASS SPC
65HO2	92U	238	G,F	NOX	7	D 7	SCI-I		4PI	
65KI1	92U	238	G,F	ABY	6- 7	C 5- 7	ACT-I		4PI	
65MA3	92U	238	G,F	ABX	5- 8	D 5- 8	EMU-D		4PI	
65NI1	92U	238	G,F	RLY	THR- 15	C 10- 15	BF3-I		4PI	
65SO1	92U	238	G,F	RLX	6- 7	D 6- 7			DST	TRACKS IN GLASS
66BO1	92U	238	G,F	NOX	THR- 9	C 5- 9			DST	TRACKS IN GLASS
66ME2	92U	238	G,F	ABY	17	D 17	ACT-I		4PI	
66SA1	92U	238	G,F	RLY	THR-650	C650	ACT-I		4PI	

NEPTUNIUM Z=93

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	DETECTOR TYPE	MIN-MAX	ANG	REMARKS
58KA2	93NP	237	G,F	ABX	5- 18	C 5- 18	ION-I		DST	
59BA4	93NP	237	G,F	RLY	THR- 20	C 6- 20	ION-I		DST	

PLUTONIUM Z=94

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	DETECTOR TYPE	MIN-MAX	ANG	REMARKS
57KA1	94PU	239	G,XN	ABX	6- 23	C 6- 23	BF3-I		4PI	
58KA2	94PU	239	G,F	ABX	5- 18	C 5- 18	ION-I		DST	
59BA4	94PU	239	G,F	RLY	THR- 20	C 6- 20	ION-I		DST	
66RA2	94PU	239	G,F	NOX	5- 7	C 5- 8			DST	
59BA4	94PU	240	G,F	RLY	THR- 20	C 6- 20	ION-I		DST	

AMERICIUM Z=95

REF	NUCLIDE Z	A	REACTION IN,OUT	RES	EXCIT	SOURCE MIN-MAX	DETECTOR TYPE	DETECTOR MIN-MAX	ANG	REMARKS
58KA2	95	AM241	G,F	ABX	5- 18	C 5- 18	ION-I		DST	
59BA4	95	AM241	G,F	RLY	THR- 20	C 6- 20	ION-I		DST	

Bibliography

In the following bibliography Conference Proceedings are indicated as follows:

PICNS-60 Proceedings of the International Conference on Nuclear Structure, Kingston, Ontario 1960 (Bromley, D. A. and Vogt, E. W., Eds., University of Toronto Press, 1960)

PICNS-61 Proceedings of the Rutherford Jubilee International Conference Manchester 1961 (Birks, J. B., Ed., Academic Press Inc., New York, 1961)

PICNS-62 Proceedings of the Conference on Direct Interactions and Nuclear Reaction Mechanisms, University of Padua 1962 (Clementel, E. and Villi, C., Eds., Gordon and Breach, New York-London, 1963)

PICNS-64 Congrès International de Physique Nucléaire, Paris 1964 (Gugenberger, P., Ed., Editions Centre Natl. Rech. Sci., Paris, 1964)

55Ba5 P. S. Baranov, V. I. Gol'danskii; Zhur. Eksp. i Teoret. Fiz. 28, 746, (1955); Soviet Phys. JETP 1, 613 (1955)

55Bu1 J. L. Burkhardt; Phys. Rev. 100, 192 (1955)

55Ca2 J. H. Carver, H. J. Hay, E. W. Titterton; Phil Mag. 46, 841 (1955)

55Er1 P. Erdos, P. Jordan, P. Stoll; Helv. Phys. Acta 28, 322 (1955)

55Gl1 H. Glattli, E. Loepfe, P. Stoll; Helv. Phys. Acta 28, 366 (1955)

55Go1 F. K. Goward, J. J. Wilkins; Proc. Roy. Soc. (London) A228, 376 (1955)

55Ka1 L. Katz, T. M. Kavanagh, A. G. W. Cameron, E. C. Bailey, J. W. T. Spinks; Phys. Rev. 99, 98 (1955)

55La1 W. B. Lasich, E. G. Muirhead, G. G. Shute; Australian J. Phys. 8, 456 (1955)

55La2 L. E. Lazareva, B. S. Ratner, I. V. Shtranikh; Zhur. Eksp. i Teoret. Fiz. 29, 274 (1955); Soviet Phys. JETP 2, 301 (1956)

55Mc1 K. G. McNeill; Phil. Mag. 46, 321 (1955)

55Mi1 M. Miwa; J. Phys. Soc. Japan 10, 273 (1955)

55Ox1 C. L. Oxley, V. L. Telegdi; Phys. Rev. 100, 435 (1955)

55Re1 D. Reagan; Phys. Rev. 100, 113

55Ri1 L. S. Ring, Jr.; Phys. Rev. 99, 137 (1955)

55Sc2 J. Schmouker, P. Erdos, P. Jordan, P. Stoll; J. Phys. Radium 16, 169 (1955)

55Sp2 B. M. Spicer, A. S. Penfold; Phys. Rev. 100, 1375 (1955)
55Sp3 B. M. Spicer; Phys. Rev. 100, 791 (1955)

56Dil D. R. Dixon, K. C. Bandtel; Phys. Rev. 104, 1730 (1956)
56Hel F. Heinrich, H. Waffler; Helv. Phys. Acta 29, 232 (1956)
56He2 F. Heinrich, H. Waffler, M. Walter; Helv. Phys. Acta 29, 3 (1956)
56Ko2 V. A. Korotkova, P. A. Cherenkov, I. V. Chuvilo; Dokl. Akad. Nauk SSSR 106, 633 (1956); Soviet Phys. Doklady 1, 77 (1956)
56Ko3 V. A. Korotkova, P. A. Cherenkov, I. V. Chuvilo; Dokl. Akad. Nauk SSSR 106, 811 (1956); Soviet Phys. Doklady 1, 104 (1956)
56Sul T. T. Sugihara, I. Halpern; Phys. Rev. 101, 1768 (1956)
56Tzl C. Tzara; Compt. Rend. 242, 2340 (1956)
56Tz2 C. Tzara; J. Phys. Radium 17, 1001 (1956)
56Wal H. Waffler, F. Heinrich; Physica 22, 1146 (1956)

57All Yu. A. Aleksandrov, N. B. Delone, L. I. Slovokhotov, G. A. Sokol, L. N. Shtarkov; Zhur. Eksp. i Teoret. Fiz. 33, 614 (1957); Soviet Phys. JETP 6, 472 (1958)
57Bal P. S. Baranov, V. I. Gol'danskii, V. S. Roganov; Zhur. Eksp. i Teoret. Fiz. 33, 1123 (1957); Soviet Phys. JETP 6, 865 (1958); Phys. Rev. 109, 1801 (1958)
57Ba2 E. B. Bazhanov, Yu. M. Volkov, A. P. Komar, L. A. Kul'chitskii, V. P. Chizhov; Dokl. Akad. Nauk SSSR 113, 65 (1957); Soviet Phys. Doklady 2, 107 (1957)
57Ba3 R. Basile; Ann. Phys. (Paris) 2,267 (1957)
57Ba4 B. P. Bannik, N. M. Kulikova, L. E. Lazareva, V. A. Yakovlev; Zhur. Eksp. i Teoret. Fiz. 33, 53 (1957); Soviet Phys. JETP 6, 39 (1958)
57Bel J. B. Bellicard, J. Miller, C. Tzara, J. Phys. Radium 18, 201 (1957)
57Bol F. Bobard, G. Boulegue, P. Chanson; Compt. Rend. 244, 1761 (1957)
57Chl I. V. Chuvilo, V. G. Shevchenko; Zhur. Eksp. i Teoret. Fiz. 32, 1335 (1957); Soviet Phys. JETP 5, 1090 (1957)
57Ell A. El Sioufi, P. Erdos, P. Stoll; Helv. Phys. Acta 30, 264 (1957)
57El2 A. El Sioufi, P. Erdos, P. Stoll; Helv. Phys. Acta 30 266 (1957)
57Kal L. Katz, K. G. McNeill, M. LeBlanc, F. Brown; Can. J. Phys. 35, 470 (1957)
57Knl V. Knapp; Proc. Phys. Soc. (London) A70, 142 (1957)
57Ko2 A. P. Komar, I. P. Yavor; Zhur. Eksp. i Teoret. Fiz. 31, 531 (1956); Soviet Phys. JETP 4, 432 (1957)

57Li1 D. L. Livesey; Can. J. Phys. 35, 987 (1957)
57Mu1 J. Muto, E. Takekoshi, T. Nakamura, A. Imamura, Y. Tsuneoka; J. Phys. Soc. Japan 12, 109 (1957)
57Ro1 M. Rozkos; Czech. J. Phys. 7, 592 (1957)
57Ro2 M. Rozkos; Czech. J. Phys. 7, 20 (1957)
57Sc1 F. D. Schupp, C. B. Colvin, D. S. Martin, Jr.; Phys. Rev. 107, 1058 (1957)
57Sc2 R. A. Schmitt, R. B. Duffield; Phys. Rev. 105, 1277 (1957)

58Ba3 M. Q. Barton, J. H. Smith; Phys. Rev. 110, 1143 (1958)
58Ba5 R. Basile and M. Gusakow; Compt. Rend. 246, 588 (1958)
58Ba6 E. B. Bazhanov, Yu. M. Volkov, L. A. Kul'chitskii; Zhur. Eksp. i Teoret. Fiz. 35, 322 (1958); Soviet Phys. JETP 8, 224 (1959)
58Ba7 A. I. Baz, N. M. Kulikova, L. E. Lazareva, N. V. Nikitina, V. A. Semenov; Int. Conf. Peaceful Uses of Atomic Energy 15, 2037 (1958)
58Be3 O. Beckman, R. Sandstrom; Nuclear Phys. 5, 595 (1958)
58Bo1 O. V. Bogdankevich, B. S. Dolbilkin, L. E. Lazareva, F. A. Nikolaev; PICNS 697 (1958)
58Bu1 N. A. Burgov, Yu. V. Terekhov; J. Nucl. Energy 7, 247 (1958)
58Fa2 H. Faissner, F. Gonnenwein; Z. Physik 153, 257 (1958)
58Gr1 G. M. Griffiths; Proc. Phys. Soc. (London) 72, 337 (1958)
58Ha1 A. Halsteinslid, K. Nybo, R. B. Mollerud; Univ. Bergen Arb. Naturv. R. 15, 1 (1958)
58Ka1 L. Katz, A. P. Baerg, F. Brown; Peaceful Uses of Atomic Energy, Switzerland 1958)
58Ma1 V. N. Maikov; Zhur. Eksp. i Teoret. Fiz. 34, 1406 (1958); Soviet Phys. JETP 7, 973 (1958)
58Ta2 C. A. Tatro, T. R. Palfrey, Jr., R. M. Whaley, R. O. Haxby; Phys. Rev. 112, 932 (1958)

59Ba3 W. C. Barber, W. D. George; Phys. Rev. 116, 1551 (1959)
59Ba4 A. P. Baerg, R. M. Bartholomew, F. Brown, L. Katz, S. B. Kowalski; Can. J. Phys. 37, 1418 (1959)
59Bo1 M. Bormann, H. Neuert; Z. Naturforsch. 14a, 922 (1959)
59Ch1 V. P. Chizhov, L. A. Kul'chitskii; Zhur. Eksp. i Teoret. Fiz. 36, 345 (1959); Soviet Phys. JETP 9, 239 (1959)
59Co6 S. G. Cohen; Nuovo Cimento 14, 931 (1959)
59Da1 F. Daublin, F. Berthold, P. Jensen; Z. Naturforsch. 14a, 208 (1959)
59Di1 G. Di Caporiacco, M. Mando, F. Ferrero; Nuovo Cimento 13, 522 (1959)
59Ha2 F. I. Havlicek; Nuovo Cimento 13, 969 (1959)
59Ik1 N. Ikeda, K. Yoshihara; Radioisotopes (Tokyo) 8, 24 (1959)

59Ko2 A. P. Komar, T. N. Dragnev; Dokl. Akad. Nauk SSSR 126, 1234 (1959); Soviet Phys. Doklady 4, 653 (1959)
59Ku2 Chi-Ti Kuo, B. S. Ratner; Dokl. Akad. Nauk SSSR 125, 761 (1959); Soviet Phys. Doklady 4, 369 (1959)
59La1 M. Langevin, A. Bussiere de Nercy; J. Phys. Radium 20, 831 (1959)
59Ma1 E. D. Makhnovskii; Zhur. Eksp. i Teoret. Fiz. 36, 739 (1959); Soviet Phys. JETP 9, 519 (1959)
59Pa3 P. Paul, U. Stierlin; Nuclear Phys. 13, 576 (1959)
59Pe5 A. S. Penfold, E. L. Garwin; Phys. Rev. 116, 120 (1959)
59Ro3 J. P. Roalsvig, R. N. H. Haslam, L. D. Skarsgard, E. E. Wuschke; Can. J. Phys. 37, 722 (1959)
59Sa1 D. Sadeh; Compt. Rend. 249, 531 (1959)
59Sa2 D. Sadeh; Compt. Rend. 249, 2313 (1959)
59Se2 W. Sebaoun, H. Gauvin; Compt. Rend. 248, 791 (1959)

60Ba8 M. A. Bak, K. A. Petrzhak, Tei-Mei Chen; Izv. Akad. Nauk SSSR 24, 818 (1960)
60Bu2 A. Bussiere de Nercy; Compt. Rend. 250, 1252 (1960)
60Bu3 A. Bussiere de Nercy, M. Langevin; J. Phys. Radium 21, 293 (1960)
60De2 N. N. Delyagin; Zhur. Eksp. i Teoret. Fiz. 38, 1111 (1960); Soviet Phys. JETP 11, 803 (1960)
60Ko5 A. Komar; PICNS 494 (1960)
60Pr2 L. I. Prokhorova, G. N. Smirenkin; Atom. Energiya 8, 457 (1960)
60Re2 J. M. Reid, B. Lalovic; Proc. Phys. Soc. (London) 76 65 (1960)
60Va1 V. J. Vanhuyse, G. J. Vanpraet; J. Phys. Radium 21, 290 (1960)

61Am1 B. Ambrozy, A. Faudrowicz, A. Jasinski, J. Kownacki, H. Lancman, J. Ludziejewski; PICNS-61 281 (1961)
61Ba3 P. S. Baranov, L. I. Slovokhotov, G. A. Sokol, L. N. Shtarkov; Zhur. Eksp. i Teoret. Fiz. 41, 1713 (1961); Soviet Phys. JETP 14, 1219 (1962)
61Bo2 B. A. Bochagov, A. P. Komar, G. E. Solyakin, V. I. Fadeev; Atom. Energiya 11, 540 (1961)
61Bo3 O. A. Borello; Rev. Un. Mat. Argent. As. Fis. Argent. 19, 251 (1961)
61Ce2 M. Cerineo, K. Ilakovac, I. Slaus, P. Tomas; Phys. Rev. 124, 1947 (1961)
61Cl1 M. A. Clark, H. E. Gove, A. E. Litherland; PICNS-61 807 (1961)
61Ga1 C. C. Gardner, P. C. Gugelot; PICNS-61 263 (1961)
61Ha1 W. D. Hamilton, B. S. Sood; Nuclear Phys. 27, 66 (1961)
61Is1 D. B. Isabelle, G. R. Bishop; J. Phys. Radium 22, 548 (1961)

61Knl H. H. Knitter, H. Waffler; PICNS-61 823 (1961)
61Pe2 G. A. Peterson, W. C. Barber; PICNS-61 831 (1961)
61Sh6 V. G. Shevchenko, B. A. Yur'ev; Izv. Akad Nauk SSSR 25, 1269 (1961)
61Ta2 N. W. Tanner, G. C. Thomas, E. D. Earle; PICNS 61 297 (1961)
61Ta3 N. W. Tanner, G. C. Thomas, E. D. Earle; PICNS-61 295 (1961)
61Wil W. S. C. Williams, H. S. Caplan, D. T. Stewart; Proc. Phys. Soc. (London) 78, 1125 (1961)

62Bl1 D. Blum, P. Barreau, J. Bellicard; PICNS-62 761 (1962)
62Fi2 F. W. K. Firk, K. H. Lokan, E. M. Bowey; PICNS-62 804 (1962)
62Fi3 F. W. K. Firk, E. R. Rae; PICNS-62 807 (1962)
62Grl G. M. Griffiths, E. A. Larson, L. P. Robertson; Can. J. Phys. 40, 402 (1962)
62Mi5 C. Milone, S. Milone Tamburino, V. Emma, S. Femino, S. Jannelli; PICNS-62 817 (1962)
62Su2 M. Suffert, G. Costa, D. Magnac-Valette; PICNS-62 842 (1962)

63Su2 M. Suffert, G. Costa, D. Magnac-Valette; J. de Phys. 24, 1029 (1963)

64Al5 F. R. Allum, T. W. Quirk, B. M. Spicer; Nuclear Phys. 53, 545 (1964)
64Be7 R. B. Begzhanov, A. A. Islamov; Zhur. Eksp. i Teoret. Fiz. 47, 768 (1964); Soviet Phys. JETP 20, 513 (1965)
64Be8 W. Bertozzi, P. Demos, F. Hanser, S. Kowalski, C. Sargent, W. Turchinetz, R. Fullwood, J. Russell; PICNS-64 1026 (1964)
64Br2 P. Brix, H. G. Clerc, R. Engfer, G. Fricke, F. Gudden, H. Liesem, E. Spamer; PICNS-64 372 (1964)
64Chl K. W. Chen, J. R. Dunning, Jr., J. R. Rees, W. Shlaer, J. K. Walker, R. Wilson; Phys. Rev. 135, 4B B1030 (1964)
64Co3 S. Costa, F. Ferrero, S. Ferroni, R. Malvano; PICNS-64 1034 (1964)
64Do2 B. S. Dolbilkin, V. A. Zapevalov, V. I. Korin, L. E. Lazareva, F. A. Nikolaev; PICNS-64 1060 (1964)
64Eal E. D. Earle, N. W. Tanner, G. C. Thomas, PICNS-64 385 (1964)
64Fi2 F. W. K. Firk, E. M. Bowey; PICNS-64 1013 (1964)
64Go4 A. N. Gorbunov, A. T. Varfolomeev; PICNS-1071 (1964)
64Ha3 S. S. Hanna, R. E. Segel, R. G. Allas; PICNS-64 1022 (1964)
64Is3 B. S. Ishkhanov, I. M. Kapitonov, B. A. Yur'ev, V. G. Shevchenko; PICNS-64 1042 (1964)
64Kil M. Kihara, K. Baba, K. Miyake, T. Nakamura, T. Yamaki, S. Yasumi, Y. Yoshimura; J. Phys. Soc. Japan 19, 2236 (1964)
64Ko5 A. P. Komar and Yu. D. Makhnovsky; Nuclear Phys. 65, 662 (1964)
64La5 M. Langevin, J. M. Loiseaux, J. M. Maison; PICNS-64 1045 (1964)
64Lo3 J. M. Loiseaux, M. Langevin, J. M. Maison; PICNS-64 1048 (1964)
64Ma2 M. Masuda, M. Kondo, S. Takeda, M. Okumura, J. Ookuma; J. Phys. Soc. Japan 19, 2339 (1964)

64Me2 F. R. Metzger; PICNS-64 392 (1964)
64Re1 T. W. Retz-Schmidt, S. J. Skorka, J. Morgenstern, H. Schmidt; PICNS-64 396 (1964)
64Se1 S. Seki, M. Yamanouchi, M. Miwa; J. Phys. Soc. Japan 19, 1999 (1964)
64Sh5 Yu. K. Shubnyi, D. K. Kaipov, R. B. Begzhanov; Zhur. Eksp. i Teoret. Fiz. 47, 16 (1964); Soviet Phys. JETP 20, 11 (1965)
64Sh6 N. K. Sherman; PICNS-64 1051 (1964)
64Su1 M. Suffert, G. Costa, D. Magnac-Valette; PICNS-64 1054 (1964)
64Th1 M. N. Thompson, J. M. Taylor, B. M. Spicer; PICNS-64 1008 (1964)
64To3 M. E. Toms; PICNS-64 1004 (1964)
64U13 H. Ullrich; PICNS-64 1038 (1964)

65Aj1 V. Ajdacic, M. Cerineo, B. Lalovic, G. Paic, I. Slaus, P. Tomas; Phys. Rev. Letters 14, 444 (1965)
65Ak1 A. F. Akkerman, V. L. Kochetkov, V. N. Chekanov; J. Nucl. Phys. (USSR) 1, 738 (1965); Sov. J. Nucl. Phys. 1, 527 (1965)
65Al1 E. Albertsson, B. Forkman; Nuclear Phys. 70, 209 (1965)
65Am1 E. Ambler, E. G. Fuller, H. Marshak; Phys. Rev. 138, B117 (1965)
65Ar1 P. E. Argan, G. Mantovani, A. Piazzoli; Nuovo Cimento 37, 376 (1965)
65Ar2 P. E. Argan, L. Meneghetti, S. Vitale; Nuovo Cimento 38, 1489 (1965)
65Ar3 H. Artus; Z. Naturforschg. 20, 320 (1965)
65As1 J. G. Asbury and F. J. Loeffler; Phys. Rev. 137, B1214 (1965)
65Ba1 E. B. Bazhanov, A. P. Komar, A. V. Kulikov, V. I. Ogurtzov; Phys. Letters 19, 239 (1965)
65Ba2 E. B. Bazhanov, A. P. Komar, A. V. Kulikov, E. D. Makhnovsky; Nuclear Phys. 68, 191 (1965)
65Ba3 G. Baciu, G. C. Bonazzola, B. Minetti, C. Molino, L. Pasqualini, G. Piragino; Nuclear Phys. 67, 178 (1965)
65Ba4 W. C. Barber, G. J. Vanpraet; Nuclear Phys. 72, 63 (1965)
65Be1 B. L. Berman, R. L. Bramblett, J. T. Caldwell, R. R. Harvey, S. C. Fultz; Phys. Rev. Letters 15, 727 (1965)
65Bi1 P. G. Bizzeti, A. M. Bizzeti Sona, M. Bocciolini, G. Di Caporiacco, T. Fazzini, M. Mando; Nuclear Phys. 63, 161 (1965)
65Bo1 P. Bounin, M. Croissiaux; Nuclear Phys. 70, 401 (1965)
65Bo2 R. Bosch, J. Lang, R. Muller, W. Wolfli; Helv. Phys. Acta 38, 753 (1965)
65Bu1 H. v. Buttlar, A. Goldmann; Z. Physik 187, 355 (1965)
65Ca1 J. T. Caldwell, R. L. Bramblett, B. L. Berman, R. R. Harvey, S. C. Fultz; Phys. Rev. Letters 15, 976 (1965)
65Ca2 P. H. Cannington, R. J. J. Stewart, G. R. Hogg, K. H. Lokan, D. G. Sargood; Nuclear Phys. 72, 23 (1965)
65Ca3 F. Carbonara, H. G. DeCarvalho, R. Rinzivillo, E. Sassi, G. P. Murtas; Nuclear Phys. 73, 385 (1965)
65Ch1 B. T. Chertok, E. C. Booth; Nuclear Phys. 66, 230 (1965)
65Cl1 H. G. Clerc, R. J. Stewart, R. C. Morrison; Phys. Letters 18, 316 (1965)

65Co1 S. Costa, F. Ferrero, S. Ferroni, L. Pasqualini, E. Silva; Nuclear Phys. 72, 158 (1965)
65Co2 S. Costa, B. Minetti, C. Molino, L. Pasqualini, G. Piragino; Atti Cl. di Sci. Fis. 99, 1157 (1965)
65Co3 S. Costa, F. Ferrero; Mat. Nat. 99, 85 (1965)
65Cr1 M. Croissiaux, R. Hofstadter, A. E. Walker, M. R. Yearian, D. G. Ravenhall, B. C. Clark, R. Herman; Phys. Rev. 137, B865 (1965)
65Da1 P. J. Dallimore, K. S. Lam and H. H. Thies; Aust. J. Phys. 18, 389 (1965)
65De1 G. Dearnaley, D. S. Gemmell, B. W. Hooton, G. A. Jones; Nuclear Phys. 64, 177 (1965)
65De2 R. W. Detenbeck, J. C. Armstrong, A. S. Figuera, J. B. Marion; Nuclear Phys. 72, 552 (1965)
65Do1 B. S. Dolbilkin, V. I. Korin, L. E. Lazareva, F. A. Nikolaev; Phys. Letters 17, 49 (1965)
65Do2 B. S. Dolbilkin, V. I. Korin, L. E. Lazareva, F. A. Nikolaev, V. A. Zapevalov; Nuclear Phys. 72, 137 (1965)
65Do3 B. S. Dolbilkin, V. I. Korin, F. A. Nikolaev; ZhETF Pis'ma 1, No. 5 (1965); JETP Letters 1, 148 (1965)
65Eh1 D. Ehhalt, R. Kosiek, R. Pfeiffer; Z. fur Physik 187, 210 (1965)
65Fe1 V. N. Fetisov, A. N. Gorbunov, A. T. Varfolomeev; Nuclear Phys. 71, 305 (1965)
65Fi1 D. S. Fielder, J. Le Tourneux, K. Min, W. D. Whitehead; Phys. Rev. Letters 15, 33 (1965)
65Fr1 R. Frosch, R. E. Rand, M. R. Yearian, H. L. Crannell, L. R. Suelzle; Phys. Letters 19, 155 (1965)
65Fr2 G. Fricke, G. R. Bishop, D. B. Isabelle; Nuclear Phys. 67, 187 (1965)
65Ga1 J. Garvey, B. H. Patrick, J. G. Rutherglen, I. L. Smith; Nuclear Phys. 70, 241 (1965)
65Gi1 M. Giannini, P. Oliva, D. Prosperi, S. Sciuti; Nuclear Phys. 65, 344 (1965)
65Go1 B. I. Goryachev, B. S. Ishkhanov, I. M. Kapitonov, V. G. Shevchenko, B. A. Yur'ev; J. Nucl. Phys. (USSR) 1, 1005 (1965); Sov. J. Nucl. Phys. 1, 716 (1965)
65Ha1 E. Hayward, T. Stovall; Nuclear Phys. 69, 241 (1965)
65Ha2 F. I. Havlicek, M. Modesto; Energia Nucleare 12, 77 (1965)
65Ho1 G. R. Hogg; Nuclear Phys. 72, 167 (1965)
65Ho2 M. Holmberg, H. Conde; Arkiv for Fysik 29, 301 (1965)
65Je1 R. W. Jewell, W. John, J. E. Sherwood, D. H. White; Phys. Rev. 139, B71 (1965)
65Ke1 E. F. Kennedy, W. C. Miller; Nuclear Phys. 63, 634 (1965)
65Kh1 N. A. Khan, V. K. Rasmussen; Phys. Rev. 138, B1385 (1965)
65Ki1 T. Kivikas, B. Forkman; Nuclear Phys. 64, 420 (1965)
65Ko1 P. Kossanyi-Demay, R. M. Lombard, G. R. Bishop, Nuclear Phys. 62, 615 (1965)
65Kr1 P. Kruger, T. M. Crawford, J. Goldemberg, W. C. Barber; Nuclear Phys. 62, 584 (1965)

65Lal H. Langevin-Joliot, C. Stephan, G. Johnson, J. Vernotte; Phys. Letters 14, 208 (1965)
65Lil F. F. Liu; Phys. Rev. 138, B1443 (1965)
65Mal J. M. Maison, M. Langevin, J. M. Loiseaux; Phys. Letters 19, 308 (1965)
65Ma3 A. Manfredini, M. Muchnik, L. Fiore, C. Ramorino, H. G. De Carvalho, J. Lang and R. Muller; Nuclear Phys. 74, 377 (1965)
65Ma4 G. Manuzio, G. Ricco, M. Sanzone; Nuovo Cimento 39, 1057 (1965)
65Ma5 G. Manuzio, R. Malvano, G. Ricco, M. Sanzone; Nuovo Cimento 40B, 300 (1965)
65Ma6 S. Matsumoto, H. Yamashita, T. Kamae, Y. Nogami; J. Phys. Soc. Japan 20, 1321 (1965)
65Mcl J. A. McIntyre, J. D. Randall; Phys. Letters 17, 137 (1965)
65Mc2 W. R. McMurray, I. J. Van Heerden, G. Wiechers; Nuclear Phys. 72, 113 (1965)
65Mel F. R. Metzger; Phys. Rev. 137, B1415 (1965)
65Me2 L. Meneghetti, S. Vitale; Nuclear Phys. 61, 316 (1965)
65Me3 F. R. Metzger; Phys. Rev. 139, B1464 (1965)
65Mil K. Min, W. D. Whitehead; Phys. Rev. 137, B301 (1965)
65Mol R. C. Morrison, J. R. Stewart, J. S. O'Connell; Phys. Rev. Letters 15, 367 (1965)
65Mo2 J. Moffatt, D. Reitmann; Nuclear Phys. 65, 130 (1965)
65Nil O. P. Nikotin, K. A. Petrzhak; Atom. Energ. 19, 185 (1965); Sov. At. Energy 19, 1080 (1965)
65Pal P. Paul, S. L. Blatt, D. Kohler; Phys. Rev. 137, B493 (1965)
65Rel M. A. Reimann, J. R. MacDonald, J. B. Warren; Nuclear Phys. 66, 465 (1965)
65Rol J. P. Roalsvig; Can. J. Phys. 43, 330 (1965)
65Sal C. P. Sargent, W. Bertozzi, P. T. Demos, J. L. Matthews, W. Turchinetz; Phys. Rev. 137, B89 (1965)
65Scl R. Schrack, D. Kohler, N. G. Puttaswamy, W. E. Meyerhof; Phys. Letters 18, 327 (1965)
65Sel R. E. Segel, S. S. Hanna, R. G. Allas; Phys. Rev. 139, B818 (1965)
65Sil P. P. Singh, R. E. Segel, L. Meyer-Schutzmeister, S. S. Hanna, R. G. Allas; Nuclear Phys. 65, 577 (1965)
65Sol A. S. Soldatov, Z. A. Aleksandrova, L. D. Gordeeva, G. N. Smirenkin; J. Nucl. Phys. (USSR) 1, 471 (1963); Sov. J. Nucl. Phys. 1, 335 (1965)
65Spl E. Spamer, F. Gudden; Phys. Letters 14, 210 (1965)
65Stl J. R. Stewart, R. C. Morrison, J. S. O'Connell; Phys. Rev. 138, B372 (1965)
65St2 R. J. J. Stewart, P. H. Cannington, B. M. Spicer; Aust. J. Phys. 18, 661 (1965)
65Swl C. P. Swann; Phys. Rev. 139, B271 (1965)
65Tal N. W. Tanner; Nuclear Phys. 61, 297 (1965)
65Thl M. N. Thompson, J. M. Taylor, D. V. Webb; Phys. Letters 14, 223 (1965)
65Th2 M. N. Thompson, J. M. Taylor, B. M. Spicer, J. E. E. Baglin; Nuclear Phys. 64, 486 (1965)

65Val A. T. Varfolomeev, A. N. Gorbunov; Zhur. Eksp. i Teoret. Fiz. 47, 30 (1964); Soviet Phys. JETP 20, 20 (1965)
65Va2 G. J. Vanpraet; Phys. Letters 17, 120 (1965)
65Va3 J. R. Van Hise, R. A. Meyer, J. P. Hummel; Phys. Rev. 139, B554 (1965)
65Va4 G. J. Vanpraet; Nuclear Phys. 74, 219 (1965)
65Va5 A. K. Val'ter, E. G. Kopanets, S. P. Tsytko; Izv. Akad. Nauk SSSR Ser. Fiz. 29, 803 (1965); Bull. Acad. Sci. USSR (Phys. Sci.) 29, 806 (1965)
65Vel V. V. Verbinski, J. C. Courtney; Nuclear Phys. 73, 398 (1965)
65Wal A. Wataghin, M. Scotto, G. Paoli; Nuovo Cimento 40B, 441 (1965)
65Wyl J. M. Wyckoff, B. Ziegler, H. W. Koch, R. Uhlig; Phys. Rev. 137, B576 (1965)

66Anl D. W. Anderson, B. C. Cook, J. A. Kadlecek; Nuclear Phys. 83, 584 (1966)
66Arl H. Artus; Z. Physik 189, 355 (1966)
66Atl U. Atzmony, S. Ofer; Phys. Rev. 145, B915 (1966)
66At2 U. Atzmony, E. R. Bauminger, S. Ofer; Nuclear Phys. 89, 433 (1966)
66Axl P. Axel, J. Miller, C. Schuhl, G. Tamas, C. Tzara; J. Phys. et Rad. 27, 262 (1966)
66Bal E. B. Bazhanov, A. P. Komar, A. V. Kulikov, V. I. Ogurtsov; Dokl. Akad. Nauk. SSSR 167, 1263 (1966); Sov. Phys. Doklady 11, 332 (1966)
66Ba2 D. Bachelier, M. Bernas, I. Brissaud, C. Detraz, J. P. Didelez, H. Langevin-Joliot, J. Lee, P. Radvanyi; Phys. Letters 21, 697 (1966)
66Ba3 A. E. Balabanov, N. N. Delyagin, H. el Sayes; J. Nucl. Phys. (USSR) 3, 209 (1966); Sov. J. Nucl. Phys. 3, 150 (1966)
66Ba4 E. B. Bazhanov, A. P. Komar, A. V. Kulikov, V. I. Ogurtsov; J. Nucl. Phys. (USSR) 3, 711 (1966); Sov. J. Nucl. Phys. 3, 522 (1966)
66Bel I. Bergqvist, B. Lundberg, L. Nilsson, N. Starfeld; Phys. Letters 19, 670 (1966)
66Be2 G. B. Beard; Phys. Rev. 145, B862 (1966)
66Be3 G. Ben-David, B. Arad, J. Balderman, Y. Schlesinger; Phys. Rev. 146, B852 (1966)
66Be4 B. L. Berman, G. S. Sidhu, C. D. Bowman; Phys. Rev. Letters 17, 761 (1966)
66Bil G. Bishop, S. Costa, S. Ferroni, R. Malvano, G. Ricco, Nuovo Cimento 42B, 158 (1966)
66Bol I. E. Bocharova, V. G. Zolotukhin, S. P. Kapitza, G. N. Smirenkin, A. S. Soldatov, Yu. M. Tsipenyuk; Zhur. Eksp. i Teoret. Fiz. 49, 476 (1965); Sov. Phys. JETP 22, 335 (1966)
66Brl R. L. Bramblett, J. T. Caldwell, B. L. Berman, R. R. Harvey, S. C. Fultz; Phys. Rev. 148, B1198 (1966)
66Cal Y. Cauchois, Y. Heno, M. Boivin; C. R. Acad. Sci. Paris 262, B503 (1966)

66Cl1 H. G. Clerc, K. J. Wetzel, E. Spamer; Phys. Letters 20, 667 (1966)
66Co1 B. C. Cook, J. E. E. Baglin, J. N. Bradford, J. E. Griffin; Phys. Rev. 143, B712 (1966)
66Co2 B. C. Cook, J. E. E. Baglin, J. N. Bradford, J. E. Griffin; Phys. Rev. 143, B724 (1966)
66Co3 B. C. Cook, D. R. Hutchinson, R. C. Waring, J. N. Bradford, R. G. Johnson, J. E. Griffin; Phys. Rev. 143, B730 (1966)
66Co4 S. Costa, L. Pasqualini, G. Piragino, L. Roasio; Nuovo Cimento 42B, 306 (1966)
66Co5 S. Costa, F. Ferrero, C. Manfredotti, L. Pasqualini, L. Roasio; Nuovo Cimento 42B, 382 (1966)
66Cr1 H. Crannell; Phys. Rev. 148, B1107 (1966)
66De1 N. De Botton, J. Miller, C. Schuhl, G. Tamas, C. Tzara; Nuclear Phys. 75, 396 (1966)
66De2 A. De Marco, R. Garfagnini, G. Piragino; Nuovo Cimento 44B, 172 (1966)
66De3 A. De Marco, R. Garfagnini, G. Piragino; Nuovo Cimento 42B, 355 (1966)
66De4 V. P. Denisov, L. A. Kul'chitskii; J. Nucl. Phys. (USSR) 2, 70 (1965); Sov. J. Nucl. Phys. 2, 48 (1966)
66De5 V. P. Denisov, A. Duisebaev, K. V. Kosareva, P. A. Cerenkov; J. Nucl. Phys. (USSR) 1, 82 (1965); Sov. J. Nucl. Phys. 2, 58 (1966)
66De6 V. P. Denisov, L. A. Kul'chitskii; J. Nucl. Phys. (USSR) 3, 268 (1966); Sov. J. Nucl. Phys. 3, 192 (1966)
66Do1 E. J. Dowdy, J. A. McIntyre; Phys. Rev. 145, B982 (1966)
66Du1 M. A. Duguay, C. K. Bockelman, T. H. Curtis, R. A. Eisenstein; Phys. Rev. Letters 17, 28 (1966)
66Du2 J. Dubois, S. Maripuu, O. Almen; Ark. Fysik 31, 65 (1966)
66Ev1 A. E. Evans, B. Brown, J. B. Marion; Phys. Rev. 149, 863 (1966)
66Fe1 F. Ferrero, C. Manfredotti, L. Pasqualini, G. Piragino P. G. Rama; Nuovo Cimento 45B, 273 (1966)
66Fi1 F. W. K. Firk; Nuclear Instr. & Methods 43, 312 (1966)
66Fo1 G. M. Fossa, G. Ricco, C. Manfredotti; Nuovo Cimento 43B, 347 (1966)
66Fo2 P. D. Forsyth, H. T. Tu and W. F. Hornyak; Nuclear Phys. 82, 33 (1966)
66Fr1 L. Frevert, W. Schott, H. Langhoff, A. Flammersfeld; Z. Physik 194, 248 (1966)
66Fu1 S. C. Fultz, J. T. Caldwell, B. L. Berman, R. L. Bramblett, R. R. Harvey; Phys. Rev. 143, B790 (1966)
66Ge1 H. M. Gerstenberg, J. S. O'Connell; Phys. Rev. 144, B834 (1966)
66Go1 J. Goldemberg, C. Schaerf; Phys. Letters 20, 193 (1966)
66Go2 A. Goldmann, P. Kneisel, H. v. Buttlar; Z. Physik, 192, 282 (1966)
66Gr1 R. C. Greenwood, W. W. Black; Phys. Letters 21, 702 (1966)
66Gr2 B. Grossetete, S. Jullian, P. Lehmann; Phys. Rev. 141, B1435 (1966)

66Ho1 P. Holmberg; Comm. Phys. Math. Ed. Soc. Sci. Fennica 31, 1 (1966)
66Ho2 J. H. Hough, W. L. Mouton; Nuclear Phys. 76, 248 (1966)
66Ho3 H. Hoffmann, B. Prowe, H. Ullrich; Nuclear Phys. 85, 631 (1966)
66Hr1 B. Hrastnik, V. Knapp, M. Vlatkovic; Nuclear Phys. 89, 412 (1966)
66Hu1 E. B. Hughes, T. A. Griffy, R. Hofstadter, M. R. Yearian; Phys. Rev. 146, B973 (1966)
66Hu2 E. B. Hughes, M. R. Yearian, R. Hofstadter; Phys. Rev. 151, 841 (1966)
66Iv1 V. G. Ivanchenko, B. S. Ratner; ZhETF Pis'ma 3, No. 11, 452 (1966); JETP Letters 3, No. 11, 296 (1966)
66Ko1 P. Kossanyi-Demay, G. J. Vanpraet; Nuclear Phys. 81, 529 (1966)
66Ko2 R. Kosiek, D. Muller, R. Pfeiffer, O. Merwitz; Phys. Letters 21, 199 (1966)
66La1 H. Langhoff, L. Frevert, W. Schott, A. Flammersfeld; Nuclear Phys. 79, 145 (1966)
66Le1 H. P. Leenhouts, P. M. Endt; Physica 32, 322 (1966)
66Li1 H. Lichtblau, B. M. Spicer; Aust. J. Phys. 19, 297 (1966)
66Li2 H. Liesem; Z. Physik 196, 174 (1966)
66Lo1 W. A. Lochstet, W. E. Stephens; Phys. Rev. 141, B1002 (1966)
66Ma1 G. E. Manuzio, G. Ricco, M. Sanzone; Nuovo Cimento 42B, 348 (1966)
66Ma2 J. M. Maison, M. Langevin, J. M. Loiseaux; J. Physique Colloq. 1, 36 (1966)
66Me1 F. R. Metzger, R. S. Raghavan; Phys. Rev. 145, B968 (1966)
66Me2 J. L. Meason, P. K. Kuroda; Phys. Rev. 142, 691 (1966)
66Me3 F. R. Metzger, G. K. Tandon; Phys. Rev. 148, B1133 (1966)
66Mi1 K. Min; Phys. Rev. 152, 1062 (1966)
66Ne1 B. M. K. Nefkens, D. C. Sutton, M. N. Thompson; Nuclear Phys. 88, 523 (1966)
66Ob1 E. Obst, F. Rauch, E. Rossle; Phys. Letters 21, 50 (1966)
66Ow1 R. O. Owens, J. E. E. Baglin; Phys. Rev. Letters 17, 1268 (1966)
66Pa1 G. Paoli, M. Scotto, A. Wataghin; Nuovo Cimento 43B, 189 (1966)
66Pa2 V. Parikh; Nuclear Phys. 77, 157 (1966)
66Pa3 A. W. Parker, R. R. Whitehead, G. G. Shute; Aust. J. Phys. 19, 147 (1966)
66Pa4 P. D. Parker; Phys. Rev. 150, 851 (1966)
66Pe1 G. A. Peterson, J. F. Ziegler; Phys. Letters 21, 543 (1966)
66Pr1 G. Proca, D. Isabelle, J. Goldemberg; J. Physique Colloq. 1, 105 (1966)
66Pu1 N. G. Puttaswamy, D. Kohler; Phys. Letters 20, 288 (1966)
66Ra1 R. S. Raghavan; Phys. Rev. 143, B947 (1966)
66Ra2 N. S. Rabotnov, G. N. Smirenkin, A. S. Soldatov, L. N. Usachov, S. P. Kapitza, Yu. M. Tsipenyuk, Nuclear Phys. 77, 92 (1966)

66Ril R. Riskalla, D. Vinciguerra; J. Physique Colloq. 1, 106 (1966)
66Sal K. Sakamtoto, P. J. Kuroda; J. Inorg. Nucl. Chem. 28, 679 (1966)
66Scl P. J. Scanlon; Nuclear Phys. 88, 424 (1966)
66Shl N. K. Sherman, J. R. Stewart, R. C. Morrison; Phys. Rev. Letters 17, 31 (1966)
66Sh2 N. Shikazono, H. Takekoshi, T. Shoji; J. Phys. Soc. Japan 21, 829 (1966)
66Spl E. Spamer; Z. Physik, 191, 24 (1966)
66Stl R. R. Stevens, Jr., Y. K. Lee, J. C. Walker; Phys. Letters 21, 401 (1966)
66St2 M. Stroetzel, F. Gudden; Phys. Letters 22, 485 (1966)
66Sul M. Suffert, Nuclear Phys. 75, 226 (1966)
66Swl C. P. Swann, Phys. Rev. 148, B1119 (1966)
66Tal J. R. Tatarczuk, H. A. Medicus; Phys. Rev. 143, B818 (1966)
66Thl M. N. Thompson, J. M. Taylor; Nuclear Phys. 76, 377 (1966)
66Val G. J. Vanpraet, W. C. Barber; Nuclear Phys. 79, 550 (1966)
66Va2 H. A. Van Rinsvelt, P. M. Endt; Physica 32, 513 (1966)
66Va3 A. T. Varfolomeev, A. N. Gorbunov, G. G. Taran; J. Nucl. Phys. (USSR) 3, 647 (1966); Sov. J. Nucl. Phys. 3, 473 (1966)
66Va4 C. Van der Leun, N. C. Burhoven Jaspers; Nuclear Phys. 88, 235 (1966)
66Vel A. Veres, I. Pavlicsek; Int. J. App. Rad. & Isotopes 17, 69 (1966)
66Vol Yu. M. Volkov, A. P. Komar, V. P. Chizhov; J. Nucl. Phys. (USSR) 3, 277 (1966); Sov. J. Nucl. Phys. 3, 198 (1966)
66Vul P. H. Vuister; Nuclear Phys. 83, 593 (1966)
66Wal W. B. Walters, J. P. Hummel; Phys. Rev. 150, 867 (1966)
66Wel E. Wernbom-Selin, S. E. Arnell; Ark. Fysik 31, 113 (1966)
66Wil Bjorn Wiik; Z. Physik 189, 423 (1966)
66Wol W. Wolfli, R. Bosch, J. Lang, R. Muller, P. Marmier; Phys. Letters 22, 75 (1966)
66Yol D. H. Youngblood, G. C. Morrison, R. E. Segel; Phys. Letters 22, 625 (1966)
66Zil B. Ziegler, W. Buss, H. Waffler; Nuclear Phys. 83, 145 (1966)

67Bal G. Barbiellini, C. Bernardini, F. Felicetti, G. P. Murtas; Phys. Rev. 154, 988 (1967)
67Ba2 E. B. Bazhanov, A. P. Komar, A. V. Kulikov; Dokl. Akad. Nauk. SSSR 171, 549 (1966); Sov. Phys. Doklady 11, 953 (1967)
67Bul H. v. Buttlar, F. Freund, G. Gammel; Z. Physik 200, 1 (1967)
67Chl C. Chasman, K. W. Jones, R. A. Ristinen, J. T. Sample; Phys. Rev. Letters 18, 219 (1967)
67Col S. Costa, F. Ferrero, C. Manfredotti, L. Pasqualini, G. Piragino, H. Arenhovel; Nuovo Cimento 48B, 460 (1967)
67Crl H. Crannell, T. A. Griffy, L. R. Suelzle, M. R. Yearian; Nuclear Phys. A90, 152 (1967)

67Cr2 H. Crannell, H. A. Dahl, F. H. Lewis, Jr.; Phys. Rev. 155, 1062 (1967)
67Eal E. D. Earle, N. W. Tanner; Nuclear Phys. A95, 241 (1967)
67Esl G. P. Estes, K. Min; Phys. Rev. 154, 1104 (1967)
67Frl R. F. Frosch, H. L. Crannell, J. S. McCarthy, R. E. Rand, R. S. Safrata, L. R. Suelzle, M. R. Yearian; Phys. Letters 24B, 54 (1967)
67Gel K. N. Geller, E. G. Muirhead, L. D. Cohen; Nuclear Phys. A96, 397 (1967)
67Gol B. I. Goryachev, B. S. Ishkhanov, I. M. Kapitonov, Zh. M. Seliverstova, V. G. Shevchenko, B. A. Yur'ev; J. Nucl. Phys. (USSR) 4, 505 (1966); Soviet J. Nucl. Phys. 4, 359 (1967)
67Hul R. R. Hurst, D. J. Donahue; Nuclear Phys. A91, 365 (1967)
67Isl B. S. Ishkhanov, I. M. Kapitonov, V. G. Shevchenko, B. A. Yur'ev; J. Nucl. Phys. (USSR) 4, 765 (1966); Soviet J. Nucl. Phys. 4, 544 (1967)
67Knl P. Kneisel, A. Goldmann, H. v. Buttlar; Z. Physik 199, 440 (1967)
67Kol A. P. Komar, V. P. Denisov, L. A. Kul'chitskii; Dokl. Akad. Nauk. SSSR, 169, 1307 (1966); Sov. Phys. Doklady 11, 728 (1967)
67Lal H. Langhoff, M. Schumacher; Phys. Rev. 155, 1246 (1967)
67Ral R. E. Rand, R. F. Frosch, C. E. Littig, M. R. Yearian; Phys. Rev. Letters 18, 469 (1967)
67Sel R. E. Segel, Z. Vager, L. Meyer-Schutzmeister, P. P. Singh, R. G. Allas; Nuclear Phys. A93, 31 (1967)
67Spl E. Spamer, H. Artus; Z. Physik 198, 445 (1967)
67Til O. Titze, E. Spamer, A. Goldmann; Phys. Letters 24B, 169 (1967)
67Wil G. Wiechers, W. R. McMurray, I. J. Van Heerden; Nuclear Phys. A92, 175 (1967)

☆U. S. GOVERNMENT PRINTING OFFICE : 1967--301-019/32

NBS TECHNICAL PUBLICATIONS

PERIODICALS

JOURNAL OF RESEARCH reports National Bureau of Standards research and development in physics, mathematics, chemistry, and engineering. Comprehensive scientific papers give complete details of the work, including laboratory data, experimental procedures, and theoretical and mathematical analyses. Illustrated with photographs, drawings, and charts.

Published in three sections, available separately:

• Physics and Chemistry

Papers of interest primarily to scientists working in these fields. This section covers a broad range of physical and chemical research, with major emphasis on standards of physical measurement, fundamental constants, and properties of matter. Issued six times a year. Annual subscription: Domestic, $5.00; foreign, $6.00*.

• Mathematics and Mathematical Physics

Studies and compilations designed mainly for the mathematician and theoretical physicist. Topics in mathematical statistics, theory of experiment design, numerical analysis, theoretical physics and chemistry, logical design and programming of computers and computer systems. Short numerical tables. Issued quarterly. Annual subscription: Domestic, $2.25; foreign, $2.75*.

• Engineering and Instrumentation

Reporting results of interest chiefly to the engineer and the applied scientist. This section includes many of the new developments in instrumentation resulting from the Bureau's work in physical measurement, data processing, and development of test methods. It will also cover some of the work in acoustics, applied mechanics, building research, and cryogenic engineering. Issued quarterly. Annual subscription: Domestic, $2.75; foreign, $3.50*.

TECHNICAL NEWS BULLETIN

The best single source of information concerning the Bureau's research, developmental, cooperative and publication activities, this monthly publication is designed for the industry-oriented individual whose daily work involves intimate contact with science and technology—*for engineers, chemists, physicists, research managers, product-development managers, and company executives.* Annual subscription: Domestic, $1.50; foreign, $2.25*.

*Difference in price is due to extra cost of foreign mailing.

NONPERIODICALS

Applied Mathematics Series. Mathematical tables, manuals, and studies.

Building Science Series. Research results, test methods, and performance criteria of building materials, components, systems, and structures.

Handbooks. Recommended codes of engineering and industrial practice (including safety codes) developed in cooperation with interested industries, professional organizations, and regulatory bodies.

Miscellaneous Publications. Charts, administrative pamphlets, Annual reports of the Bureau, conference reports, bibliographies, etc.

Monographs. Major contributions to the technical literature on various subjects related to the Bureau's scientific and technical activities.

National Standard Reference Data Series. NSRDS provides quantitative data on the physical and chemical properties of materials, compiled from the world's literature and critically evaluated.

Product Standards. Provide requirements for sizes, types, quality and methods for testing various industrial products. These standards are developed cooperatively with interested Government and industry groups and provide the basis for common understanding of product characteristics for both buyers and sellers. Their use is voluntary.

Technical Notes. This series consists of communications and reports (covering both other agency and NBS-sponsored work) of limited or transitory interest.

CLEARINGHOUSE

The Clearinghouse for Federal Scientific and Technical Information, operated by NBS, supplies unclassified information related to Government-generated science and technology in defense, space, atomic energy, and other national programs. For further information on Clearinghouse services, write:

Clearinghouse
U.S. Department of Commerce
Springfield, Virginia 22151

Order NBS publications from:
Superintendent of Documents
Government Printing Office
Washington, D.C. 20402

U.S. DEPARTMENT OF COMMERCE
WASHINGTON, D.C. 20230

OFFICIAL BUSINESS

POSTAGE AND FEES PAID
U.S. DEPARTMENT OF COMMERCE